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APRIL 1983

80p

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RUN	SQR		'	ENTER	MAG
SIZE	SYS	STATEMENTS	UNIT	LIST	TOF
CONT	TIC	IF	BAUD	PURGE	TON
MON	SQN	ELSE	CALL	NUMBER	DIM
	BIT	ON	DATA	RENUM	DEF
FUNCTIONS	CRB	GOTO	READ	BOOT	NEW
ABS	CRF	GOSUB	RESTOR	GRAPH	END
ADR	MEM	POP	RETURN	TEXT	BIT
ASC	MWD	REM	STOP	PLOT	CRB
ATN	LEN	FOR	TIME	UNPLOT	CRF
SIN	MCH	NEXT	WAIT	COLOUR	MEM
COS	POS	ERROR	SAVE	CHAR	MWD
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Computing Today is constantly on the look-out for well written articles and programs. If you think that your efforts meet our standards, please feel free to submit your work to us for consideration.

All material should be typed. Any programs submitted must be listed (cassette tapes and discs will not be accepted) and should be accompanied by sufficient documentation to enable their implementation. Please enclose an SAE if you want your manuscript returned, all submissions will be acknowledged. Any published work will be paid for.

All work for consideration should be sent to the Editor at our Charing Cross Road address.

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PROGRAMS FOR TRS-80
(Please state model (I or III) and memory size. Level 2 only)

GAMES
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ARITHMETIC: Inexhaustible supply of test problems, program adapts to your weak points. Set your own difficulty limit. Scores displayed every ten tests. Instructions included: cassette **£7.95** sssd mini-disk **£10.95** inclusive of packing, post & VAT.

SPELL-IT: Let your children learn spelling at their own pace. Build-up your own question pages, have what subjects you wish, add more whenever you like. Instructions included: cassette **£7.95** sssd/dd mini-disk **£10.95** inclusive of packing, post & VAT.

BUSINESS
QUICK-CHANGE: Price list editor: prices of single entries or whole lists changed by user chosen factors. Minimum system required: 16K level II, please state memory size for diskette system. Instructions included: cassette **£9.95** sssd/dd mini-disk **£12.95** inclusive of packing, post; VAT extra.

COMMISSION-82: Calculates commission pay for those in small businesses. No statutory deductions. Instructions included: cassette **£9.95** sssd/dd mini-disk **£12.95** inclusive of packing, post; VAT extra.

BSQUOTE-81: Business quotations; improve them, extend with consistency yet have flexible adjustment factors. Comes with a 30 line library page with built-in tasks; create others as you need. Recall/re-use/list any pages. Run 'WHAT-IF' analyses, optimise quotations, maximise profits. Requires 48K, twin disk systems. Program and operating instructions. Mini-diskette **£79.95** plus VAT.

NEWS-80: Purpose written **NEWSAGENTS'** retail accounting package. All practical features for 280 to 2800 accounts. BILLINGS, CHANGES, ROUNDS, HOLDS/STOPS, BAD DEBTORS, etc., etc. Use in the office or at the counter. System requirements: 48K, twin sssd/dd diskettes and printer. Model I or III. Program and operating instructions for version 2 (other versions available). Mini-diskette **£599.00** plus VAT.

OPERATING SYSTEM
MINDOS: Authorised subset of Apparat's NEWDOS+. This can be supplied if required to run above 40 track disk packages: model I only. Abridges instructions included: sssd mini-disk **£15.00** price includes packing, post and VAT.

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ORIC-1 48K RAM		£169.95	
ORIC Communications Modem		£79.00	
ORIC Owner Magazine (Bi-monthly)		£10.00	
Postage and packing		£5.95	
		TOTAL £	

CONSUMER NEWS

SUCH JOY

You can now get to grips with your Dragon 32, BBC Micro and Sinclair ZX Spectrum/ZX81 with the help of new high quality analogue joysticks from Midwich. Each joystick, which has a life expectancy of more than 20,000 operations, also incorporates a push button in the handle and comes fitted with the appropriate connector for the machine in question.

A low cost, high speed four channel joystick controller board is also available for the ZX81 and ZX Spectrum. The units are priced as follows: Dragon 32, £15.98 per pair; BBC Micro, £13.00 per pair; ZX81 ZX Spectrum, £15.98 per pair; and Controller, £22.95 each (all include VAT). For more information contact Midwich Computer Company Limited, Rickinghall House, Hinderclay Road, Rickinghall, Suffolk IP22 1HH, or 'phone 0379-898751.

CHATTERBOX

Now stop talking everyone and allow the speech synthesiser to do it for you! Marketed under the highly original name of 'Chatterbox', the system comprises a programmable phoneme generator, amplifier and loudspeaker, all housed in a cabinet measuring 150 by 100 by 60 mm.

Originally designed for the Sinclair ZX81 and ZX Spectrum computers, the unit may be used with most other popular micros and comes complete with programming examples and technical explanations. Additional features include external sockets for a Speech Recognition unit and a Music Synthesiser, both from the William Stuart range. Costing £49 (excluding VAT) the Chatterbox is available from William Stuart Systems Limited, Dower House, Herongate, Brentwood, Essex CM13 3SD. The telephone number is 0277-810244.

INTERNATIONAL CONFERENCE

The CESTA (Centre d'etude de Systemes Technologiques Avancees) was established in the Spring of 1982 under the patronage of the Department of Research and Industry (France) and is now a profit-making organisation set up to evaluate new technologies and their impact on society.

Among its responsibilities CESTA has undertaken to organise a two day conference which will be attended by an international audience and will have speakers from Great Britain, France, Canada, Germany, Italy and Belgium. The topics covered will include: Approach to the use of micros in primary education, Computers in a university education, New technologies in adult education, Teaching games, Electronic courseware in publishing, The BBC Computer Literacy Project and more. For information on the Conference, which takes place on March 24 and 25 1983, please address enquiries to Ms Af Tester at CESTA, 5 rue Descartes, 75005 Paris, France (where the conference is to be held) or 'phone 010 33 1 634 32 95.

RESEARCH IN EDUCATION ▼

Research Machines are including an extra 32K of memory with their LINK 480Z primary school package at no extra cost, so it will now contain 64K of RAM as standard.

The price for a minimum entry level system is £565.00 and further information on this machine and also on the Research Machines 380Z disc based systems can be obtained from Research Machines, Microcomputer Systems, Mill Street, Oxford, OX2 OBW or 'phone 0865-249866.

IMPROVED COMMUNICATIONS

Interpod is a new type of multiple interface which enables the VIC-20 and CBM-64 to communicate with all IEEE and RS232 equipment. Plugging directly into the serial port of the computer, Interpod vastly increases the power and capabilities of both systems without any loss of memory.

This multiple interface is guaranteed compatible with any software and is priced at £95.95 excluding VAT. Further information can be obtained from Oxford Computer Systems Limited, Hensington Road, Woodstock, Oxford.

COMMODORE SPEAKS OUT

Commodore has announced a sophisticated new voice synthesizer for the Commodore 64 personal computer. This low cost add-on, developed in Dallas, Texas, is capable of generating a wide variety of voices and has the capability to integrate voice into games and learning cartridges. Pricing for the speech synthesizer has not been announced but it is expected to retail for under $100 with delivery scheduled for Spring 1983.

Gortek was recently unveiled — a new robot-like character who will be helping children learn to program in a unique series of books and cassette tapes, the first of which is entitled **Gortek and the Microchips.** Gortek comes in two versions for the Commodore VIC-20 and Commodore 64 computers.

Further information on any of the above can be obtained from Commodore Business Machines (UK) Limited, 675 Ajax Avenue, Trading Estate, Slough, Berkshire SL1 4BG or 'phone 0753-74111.

KEY TO SUCCESS ▲

Casio are pursuing the key to success by changing their traditional 'abcdef' layout of alpha keys in favour of the more common 'qwerty' order on their latest BASIC programmable micro. With its new ASCII keyboard layout, FX700P is similar in power to its predecessor FX702P. Power is increased further with the option of offline program and data storage via a new design of cassette tape recorder interface FA3. A new companion printer, FP12, should be available soon.

The Casio FX700P ASCII keyboard portable BASIC computer has a recommended retail price of £89.95, complete with a comprehensive program library. Cassette interface FA3 is £25.95 and the printer FP12 is expected to cost £54.95. You can get more information from Casio Electronics Co. Ltd., Unit 6, 1000 North Circular Road, London NW2 7JD, or on 01-450 9131.

EDUCATIONAL CONFERENCE

The University of Bristol is playing host to CAL 83, Symposium on Computer Assisted Learning, being held on April 13 to 15 1983. The Symposium will provide a forum for those interested in the theory and practice of Computer Assisted Learning in Education and Training. The programme will include lectures, extended seminars and participatory workshops. There will also be an exhibition including demonstrations by manufacturers and CAL practitioners of their latest products and exhibits by regional offices of the Microelectronics Education Project showing work in progress. There will be an open day at a concessionary rate with lectures of more general interest to enable teachers to see what CAL is about.

The conference is sponsored by Pergamon Press and the Council for Educational Technology. More details can be obtained from Dr R T Moses, Faculty of Engineering, University of Bristol, Bristol BS8 1TR or 'phone 0272-24161 ext 846.

NOW READ ON . . .

In fact you may have already been reading the books and other publications for small computers including the Tandy TRS-80 and Dragon 32 produced by Elkan Electronics. Some of these books were originally written for the TRS-80 Color Computer only and need minor amendments for use with the Dragon 32. These are now being sent with all new orders, but some of you may like to receive these amendments to use with your Dragon 32. Elkan would be pleased to send a copy free of charge to any of our readers on receipt of an SAE.

Elkan also have a range of new books, magazines and other items for the Tandy TRS-80, Dragon 32 and Sharp PC-1211 and PC-1500 computers. All enquiries should be addressed to Elkan Electronics, Freepost, 28 Bury New Road, Prestwich, Manchester M25 6LZ or 'phone 061-798 7613 (24 hour service).

JUICING UP THE FRUIT

Juice up your Tangerine Computer System with a new 40K RAM board from T H Microelectronics. It uses CMOS RAM and has battery back-up for data retention. It only needs one supply (5 volts) and is not subject to the timing problems of dynamic RAM boards (eg systems with higher clock speeds).

The price is £81 plus £1.50 postage and packing, and cheques should be made payable to T Henshaw. Acquire your board or further information from T H Microelectronics, 54 Westerlands, Stapleford, Nottingham NG9 7JG.

KEEP UNDER CONTROL

The Z-80 System Controller has recently been announced which Vertec claim will provide OEM designers and development engineers with the necessary computing power and interfacing logic required to build intelligent control and instrumentation equipment.

Features include a 2MHz Z-80 CPU, 24K EPROM and up to 16K RAM together with a Z-80 DART, Z-80 CTC and 24 programmable I/O lines. On board software includes a 12K high speed BASIC interpreter and a comprehensive Floating Point Maths Package. Plug-in function modules such as clock calendars and mains switches allow equipment enhancements to be incorporated with a minimum of engineering effort and simplify customisation.

The price is £327 including documentation with significant OEM discounts. Further details are available from Vertec Limited (Electronics), Maxwell Building, 43 The Crescent, Salford, Manchester M5 4WT or 'phone 061-736 8502.

SAVE YOURSELF £40 ON ORIGINAL PRICE BY SENDING NOW!!!

Do you own a computor? — Thinking of getting one? — or are you just interested in computors?
WHICHEVER CATEGORY YOU COME UNDER — **THIS OFFER IS FOR YOU**

DO YOU SINCERELY WANT TO BE RICH? WOULD YOU LIKE TO MAKE SOME REAL MONEY JUST WORKING WHEN YOU FEEL LIKE IT

It is a very TRUE saying—"More than half of the People in the World are Asleep"—it is the rest who make the **REAL MONEY**

Let me first of all tell you a little about myself. I am 52 years of age and I am placing this advertisement at a time that is near to my contemplated retirement. I wish retirement in order that I can find time to commence writing my second book, more of this later.

Are you unemployed?—maybe recently made redundant?—or are you just fed up with your work and need a change?—then why not **BECOME YOUR OWN BOSS** and start making some **REAL MONEY** for **YOURSELF**.

CHANGE YOUR WHOLE LIFESTYLE.

THIS WILL BE THE SUCCESS STORY, of not only 1983—**BUT OF ALL TIME**

Let me tell you—it is not so very long ago that I was BROKE, yes completely and utterly BROKE. The Bank Manager would not even see me for a loan, let alone grant me one, and I was paying off my debts by small instalments to avoid Court Action for Recovery or even Bankruptcy.

We were renting a very small, very old house (since demolished) paying at that time 10/- weekly rent—this sum we had to literally 'scrape' together each week.

We did have (I say **did** have) an old 'banger' of a car, for which I had originally paid £140 on Hire Purchase.

One day along came the Hire Purchase Company Representative to repossess the car—as I then owed them two monthly rentals of £9 each (that was the amount of the monthly rental)—so that was the end of the car and the money paid on it—all lost.

I knew then that I had to do something about this terrible state of affairs—**I KNEW I COULD DO IT**. I had been 'working on' an idea that I had held **SECRET** for many, many years.

Remember—**I WAS BROKE**—in fact, somehow I managed to save the sum of TWO POUNDS (£2) assisted by my wife who had such great faith in me, however just this two pounds to commence—I have never looked back since and I have come a very, very long way, believe me.

I NOW HAVE THREE CARS.

I HAVE A LUXURY HOME and builders have recently completed an extension for me, quite costly of course, it is worth a SIX FIGURE SUM (£100,000) to me now, or if you prefer American Dollars, about $189,000.

My wife, our daughter and myself live very, very comfortably—TO SAY THE LEAST, surely this you now realise.

To give you just two recent examples of my **weekly** payments into my bank account, WORKING PART TIME ONLY REMEMBER—

They were £3,649—THREE THOUSAND, SIX HUNDRED AND FORTY-NINE POUNDS, or if you prefer it in American Dollars, about $6,896.

The second one for £1,836—ONE THOUSAND, EIGHT HUNDRED AND THIRTY-SIX POUNDS, again if you prefer it in American Dollars, about $3,470.

Proofed this paper.

Remember, THESE ARE JUST TWO RECENT WEEKS AS EXAMPLES FOR YOU, working only PART TIME, now are you interested?

This advertisement has been written for YOU—YOU can decide which is best for you—to be broke or to HAVE MONEY—YOU DECIDE, you have my MONEY REFUND INCLUDED of course.

There are ONLY TWO KINDS OF PEOPLE IN THIS WORLD—Those who say it can't be done—**AND THOSE WHO DO IT**—like Myself and now, very shortly YOU.

The book I sell is NOT a book of ideas, whereby you have to 'sort out' and secure your own eventual business ideas—It is NOTHING LIKE THAT—it details ONE BUSINESS ONLY at which I've succeeded and at which you will now succeed—it trains you for this ONE BUSINESS ONLY, there is NOTHING ELSE.

I knew what I wanted when I was down and out—at that time NO ONE WAS INTERESTED IN MY PROBLEMS, this is natural of course—do you know what you want? If it is the ROAD TO RICHES and you SINCERELY wish it, this is for you.

Protect your future and your self respect, whilst at the same time protecting your Family in the future—START MAKING SOME REAL MONEY FOR YOURSELF and STOP DREAMING about it. I've known absolute poverty, been right down on the floor, it is not very nice—but I DID NOT INTEND TO REMAIN THERE—compare that position with what I have today—apart from my income—THREE CARS—LUXURY HOME—and, Oh Dear so much more than words can ever tell you.

I made all the mistakes, discovered all the pitfalls along the way—**and I paid for them**—none of these will befall you, as you have MY BOOK to guide you and to train you.

Operate entirely from your own Home. No telephone is necessary. No car is necessary. No knocking on doors to sell. Operate solely by post. Every man and woman is a potential customer for you.

Within THREE WEEKS of my commencing on my own, in this business, I can tell you—

I HAD PAID OFF ALMOST ALL OF MY DEBTS AND BOUGHT A CAR, yes within the first THREE WEEKS.

YOU can decide how big you wish to become, it was my intention never to get too large, so I simply 'cut down' and worked only part time, enjoying life to the full and the rest of the time doing whatever I WISHED TO DO, no matter what it was—Fantastic—yes. BUT TRUE.

I make my offer at this time, to enable me to secure more time to write my second book, it will take me at least 12-18 months, but when it is published it will prove to be a sensation, believe me.

It is my intention to pass on the SECRET OF MAKING MONEY to YOU. I KNOW you are already very anxious to learn about it. Even if you are at present employed, you will commence part time, you will soon be presenting your notice to your present employer—TO WORK FOR YOURSELF—remember my own first three weeks—I EVEN BOUGHT A CAR.

Why 'line the pockets' of your employer any longer, start 'lining your own' before you leave it too late. I am not making this offer to MAKE YOU RICH, in order to make myself rich, it is not necessary, you already know why. Working part time, my last financial year shows income well in excess of £70,000 with profits at over £11,000—yes JUST PART TIME, this can be multiplied many times if necessary. For those who wish it, in American Dollars again, this amounts to about $132,300 and profits about $20,790.

I mentioned already that "More than half of the people in the World are Asleep", this is what allows the rest of us (Me and You) to MAKE THE REAL MONEY—because you are about to become one of the AWAKE people—if you WISH TO GROW RICH.

The pessimists say—"It is not possible to succeed on your own any more"—what utter rubbish and absolute nonsense—these people belong to the category that are ASLEEP—believe me, it is easier now than ever it was, but only those who WANT TO MAKE MONEY do so, I KNOW.

I was talking to a Rolls-Royce Owner recently, who said, 'the roads are paved with gold—people just will not help themselves'—it is TRUE you know, it is there for you to help yourself. Just taking, as a small example for you my most recent four years of part time working—on each of those years my income has increased each year over the preceding one—whilst others around me have closed down and gone into Bankruptcy.

Just examine again some of the cash figures I have given you herein, this is only a part, I'm not disclosing everything to you of course, just sufficient to give you an idea of what YOU can now do in my line of business. I started with a capital of just TWO POUNDS.

This offer is made under my MONEY REFUND, it is your GOLDEN OPPORTUNITY OF A LIFETIME TO MAKE MONEY, it is YOUR SUCCESS that matters to me, hence this REFUND OFFER.

Are you prepared to send me just ten pounds (£10) to receive My Book with details of this new business for yourself, you can commence right away. The ROAD TO RICHES awaits you, despatched to your within 48 hours of your order reaching me. Money Refunded if you do not agree and you return to me within 7 days—can I be any fairer than this?

A. W. E. SUMMONS

P.O. Box 30, 8 Dew Street,
Haverfordwest,
Dyfed, Wales.

What have I got to lose. Here is my ten pounds and at the end of the first three months of my new business venture operation, **IF**, I repeat **IF** I've made a clear profit of at least £3,000 I will send you a further £40 completing payment for my book, if I have NOT made this profit, I OWE YOU NOTHING FURTHER, the balance is cancelled—on this understanding and MONEY REFUND here's my tenner.

Name .....

Address .....

.....

..... CT1

STOP PRESS LETTERS PROOFED TO THIS PAPER

Mr. K. P. of Lancs writes: My account for the first two months of operations.

Expenses (all detailed)	£615.15
Income	£3,196.00
CLEAR PROFIT	£2,580.15

He adds—"may I take this opportunity to thank you for introducing me to this most successful business venture. I am confident that it will provide me with financial security for the years ahead."

Mr. R. O. of London writes: How geateful I am in sending you a cheque for £40, for I have made a CLEAR PROFIT of £3,256.86 at the end of my 3 months period of operations. I'm now more confident that my business will provide me with financial security for the years ahead.

'I would like to add that I am very pleased you have introduced me to this profitable venture'. **J. B., Devon**.

'I have been absolutely amazed by the PROFIT I have made from it . . . thanks to YOU'. **P. J., London**.

'I am having good success'. **E. H., Yorks**.

Value - MicroValue - Micro

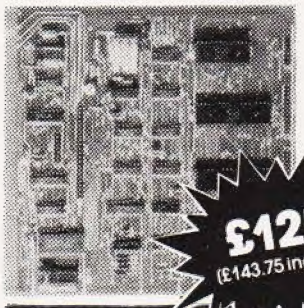
80-BUS MULTIBOARDS

The Gemini Multiboard Microsystem provides a large and growing range of fully compatible microcomputer boards. Around these boards you can configure a solution to satisfy your own particular microprocessor needs, whether you need as many as 10 boards or as few as one. This flexibility is made possible by Gemini's adoption of a number of accepted industrial standards; especially the 80-BUS, specifically designed for the Z80A

The Z80A (the high speed version of the Z80) is now the largest selling microprocessor worldwide, and forms the heart of the MultiBoard system. The principal advantage of a Z80A based system is the abundance of software that is available, and the majority of those packages operate under the CP/M disk operating system. With CP/M software becomes machine independent; providing the user with literally the widest range of software available.

With MultiBoard an almost unlimited number of system permutations are possible. Seven of the most popular boards are shown here, but there is a range of 15 available from your MicroValue dealer; together with mother boards, frames, cables, power supplies, keyboards and compatible software if required.

Your MicroValue dealer can advise you on suitable permutations to suit your requirements, whether building a system from scratch or expanding your Galaxy or Nascom computer.



GM 816 – MULTI I/O Board

- ★ Six 8-Bit I/O Ports
- ★ 4 Counter/Timer Channels
- ★ Real Time Clock
- ★ Further expansion capability

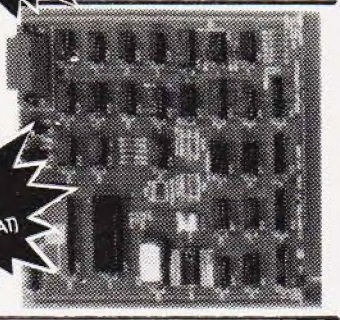
Daughter boards also available for further expansion.

£125 (£143.75 inc. VAT)

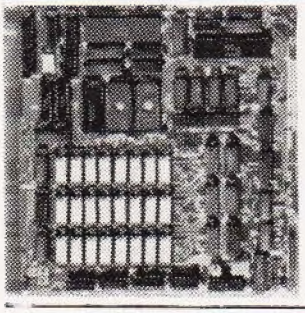
EV 814 – IEEE 488 Controller

- ★ Cost-effective Controller
- ★ Comprehensive software supplied

Controls equipment fitted with IEEE488 or GP1B interface.



£140 (£161.00 inc. VAT)

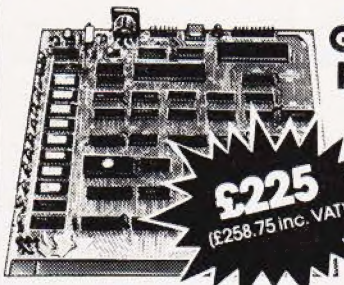


PLUTO – Colour Graphics Processor Board

- ★ 640 x 576 Bit mapped display
- ★ On-board 16-Bit microprocessor
- ★ Comprehensive on-board software

IO 828 A: 192K RAM "PLUTO" **£399** (£458.85 inc. VAT)

IO 828 B: "BABY PLUTO" 96K **£299** (£343.85 inc. VAT)



GM813 – CPU/64K RAM Board

- ★ 4 MHz Z80A CPU
- ★ 64K Dynamic RAM
- ★ RS232 Serial Interface
- ★ Two 8-Bit I/O Ports
- ★ 1200 Baud Cassette Interface
- ★ Extended and Page Addressing Modes

£225 (£258.75 inc. VAT)

The Gemini GM813 is an 80-BUS compatible CPU card incorporating 64K dynamic RAM and utilising the powerful Z80A microprocessor running at 4MHz. Extended addressing and page mode facilities allow for future memory expansion up to 2 megabytes. Input and output capabilities include both programmable serial and parallel interfaces – RS232, 1200 baud CUTS cassette interface and the Z80A PIO. When used with the GM812 video card, the GM813's unique RP/M monitor allows the creation of cassette or EPROM based programs or files which are upwards compatible with a disk based CP/M system.

GM811 – CPU Board

- ★ 4MHz Z80A CPU
- ★ Four 'Bytewide' Memory Sockets
- ★ Two 8-Bit Input/Output Ports
- ★ 8 Bit Input Port
- ★ RS232 Serial Interface
- ★ 1200 Baud CUTS Cassette Interface

£125 (£143.75 inc. VAT)

GM812 – IVC Board

- ★ 80x25 Display Format
- ★ On-board Z80A Microprocessor
- ★ Buffered Keyboard Input
- ★ Programmable Character Generator
- ★ 160x75 Pixel Graphics
- ★ Light Pen Input

£145 (£166.75 inc. VAT)

GM 829 – FDC/SASI Board

- ★ Single/Double density operation
- ★ Single/Double sided drive operation
- ★ Up to 4 mixed 3.5", 5.25" and 8" drives
- ★ Industry Standard SASI hard-disk interface

£125 (£143.75 inc. VAT)

Other boards available in the Multiboard range include:

GM802	64K Dynamic RAM Board	**£125** (£143.75 inc. VAT)
GM803	EPROM/ROM Board	**£65** (£74.75 inc. VAT)
MP826	32K Static RAM Board	**£185** (£212.75 inc. VAT)

All MultiBoards are Nasbus* compatible
Ask for latest catalogue for full details.

*Trademark of Nascom Microcomputers Division of Lucas Logic

MicroValue

REAL value – from the Professionals

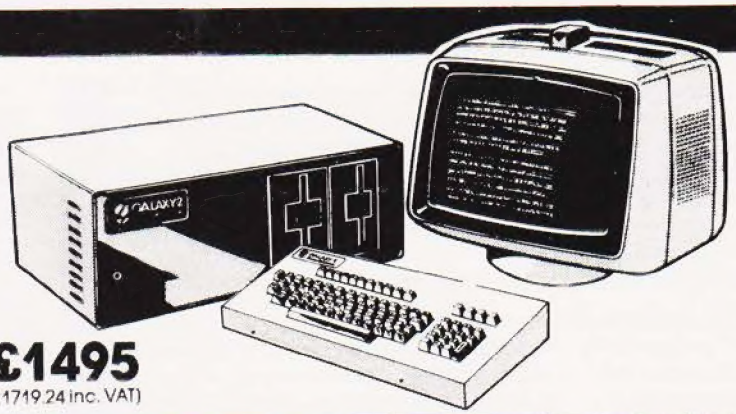
Value - MicroValue - Micro

COMPUTERS

New from Gemini

Gemini Galaxy 2

- ★Twin Z80A Processors
- ★CP/M 2.2 Operating System
- ★64K Dynamic RAM
- ★800K Disk Capacity
- ★80x25 Video Display
- ★Serial and parallel printer interfaces
- ★Cassette and light pen interfaces
- ★User definable function keys
- ★Numeric key pad
- ★12" Monitor included

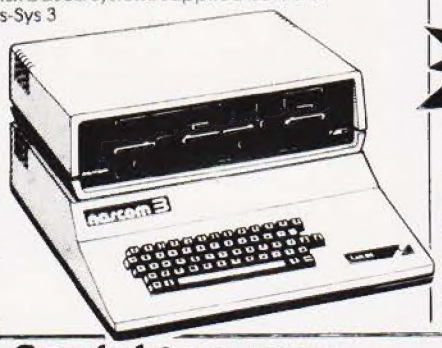


£1495
(£1719.24 inc. VAT)

Total support for Gemini & nascom Products

nascom 3 available from MicroValue

Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.



48K System
£549 (£631.35 inc. VAT)

CP/M 2.2
£100 (£115 inc. VAT)

NASCOM 2 KIT
£225 (£258.75 inc. VAT)

Built & Tested
£285 (£327.75 inc. VAT)

80x25 Video for nascom

£125 (£143.75 inc. VAT)

Nascom owners can now have a professional 80x25 Video display by using the Gemini G812 Intelligent Video Card with on-board Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Software supplied on Gemini system disks. Built and tested.

Nascom 1 Printed Circuit
(inc. parts list)
£25 (£28.75 inc. VAT)

GM802 64K RAM Card **£125** (£143.75 inc. VAT)

GM802K 16K RAM Kit **£80** (£92 inc. VAT)

Disk System for Gemini & nascom

GM825 Disk Drive Unit – The GM825 floppy disk housing is supplied with either one or two 5.25" single sided, double density, 96TPI high capacity Micropolis 1015F5 disk drives. These provide 400K bytes of formatted storage per drive. (Gemini QDSS format). The CP/M2.2 package available supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers.
An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 4, it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

Single Drive System
GM825-1S
£350 (£402.50 inc. VAT)

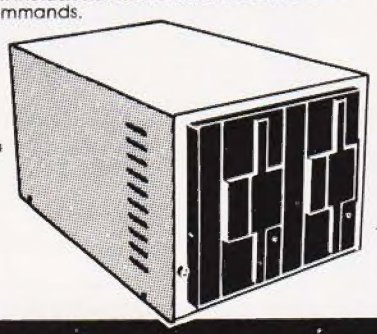
Dual Drive System
GM825-2S
£575 (£661.25 inc. VAT)

CP/M2.2 Package
(GM 532 for Gemini)
£90 (£103.50 inc. VAT)

POLYDOS 4
for Nascom
£90 (£103.50 inc. VAT)

GM809 Disk Controller Card
for 8" and 5.25" drives
£125 (£143.75 inc. VAT)

GM829
for 8", 5.25" and Winchester Drives
£145 (£166.75 inc. VAT)

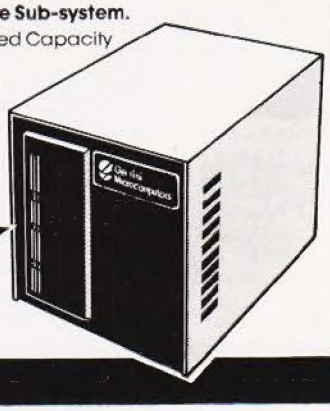


At last – a Winchester Drive for your Gemini / nascom System!

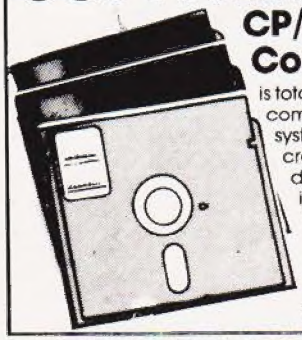
GM835 Winchester Drive Sub-system.

- ★5.4 Megabyte Formatted Capacity
- ★Rodime Drive
- ★Industry Standard SASI interface
- ★Integral Controller and power supply

£1450 (£1667.50 inc VAT)



SOFTWARE



CP/M Software

Compas
is totally different from other compiler based Pascal systems, as it allows you to create, edit, run, and debug Pascal programs in a highly interactive manner.

£120
(£138 inc. VAT)

'The Last One' is used in conjunction with Microsoft's MBASIC*. No knowledge of BASIC programming is required since all input is performed using question and answer routines written in plain English.

£330
(£379.50 inc. VAT)

*MBASIC – MicroValue Price if purchased with 'The Last One' – **£178.95 inc.VAT**

VIZ:APL is a high level language system. It can be used to develop small programs faster and large programs in limited memory. The language can be enhanced almost indefinitely and the user's own operators and functions can be built up.

£255
(£293.25 inc. VAT)

Gemini Software:

GEM PEN Text Editor	**£45**	(£51.75 inc. VAT)
GEM ZAP Assembler	**£45**	(£51.75 inc. VAT)
GEM DEBUG Debugging Utility	**£30**	(£34.50 inc. VAT)
WORDSTAR Word Processor	**£215**	(£247.25 inc. VAT)
GEM GRAPHIC Links with MBASIC	**£35**	(£40.25 inc. VAT)

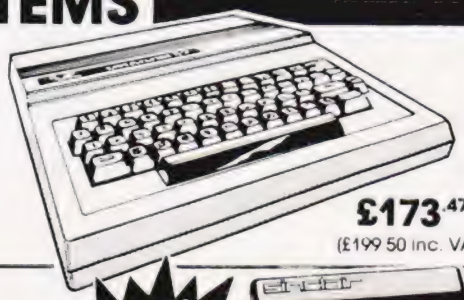
A wide range of software for Nascom also available.
When ordering disks, please specify format.

Value - MicroValue - Micro

LOW COST SYSTEMS

Dragon 32

A powerful colour computer for under £200
★32K RAM
★6809E Microprocessor
★Extended Microsoft Colour BASIC
★9 Colour, 5 Resolution Display
★Sound through TV 5 octaves, 255 tones
★Advanced Graphics
Full range of Dragon software available



£173.47
(£199.50 inc. VAT)

Sinclair ZX81

Now available through MicroValue — a real computer for less than £50!

★Sinclair ZX81 Computer	**£43.43**	(£49.95 inc. VAT)
★Sinclair ZX Printer	**£52.13**	(£59.95 inc. VAT)
★ZX81 Learning Lab	**£17.35**	(£19.95 inc. VAT)
★Software for Sinclair	**from £3.43**	(£3.95 inc. VAT)

SPECIAL OFFER
16K RAM PACK for ZX81
£17.17 + VAT

THE NEW SHARP MZ80A

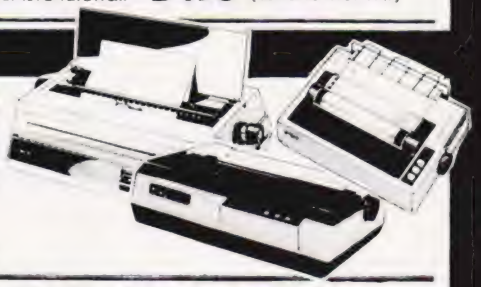
Electronic magnificence from Sharp

Z80A C.P.U. · 48K RAM · 4K ROM · Industry standard Qwerty keyboard with numeric pad · 9" GREEN C.R.T. · 1200 baud cassette · Music and sound · Real time clock · Enhanced BASIC · Full editing facilities · Internal expansion.

FREE SOFTWARE!
Home budget, bank reconciliation, SPACE INVADERS, STAR TREK, SCRAMBLE, bank loan calculator, mortgage calculator + 7 other games.
Educational — Geography, Maths., Spelling + 4 part BASIC tutorial.

£475 (£546.25 inc. VAT)

PRINTERS



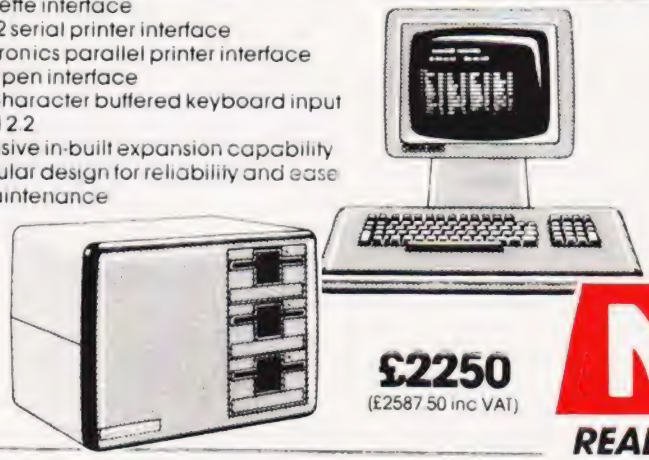
Epson MX80 Type III	**£348**	(£399.95 inc. VAT)
Epson MX80 FT Type III	**£388**	(£445.95 inc. VAT)
Epson MX100 Type III	**£496**	(£569.95 inc. VAT)
NEC 8023A	**£339**	(£389.95 inc. VAT)
SEIKOSHA GP100A	**£215**	(£246.95 inc. VAT)

Daisy Wheel Printer:

Smith-Corona TP-1 **£485** (£557.75 inc. VAT)

Quantum QM 2000 COMPUTER SYSTEM

* Twin Z80A Microprocessors
* 64K Dynamic RAM
* 2.4 megabytes of formatted disk storage capacity
* 80 × 25 screen format
* 160 × 75 pixel graphics
* Programmable character generator
* Cassette interface
* RS232 serial printer interface
* Centronics parallel printer interface
* Light pen interface
* 128 Character buffered keyboard input
* CP/M 2.2
* Extensive in-built expansion capability
* Modular design for reliability and ease of maintenance



£2250
(£2587.50 inc VAT)

Phoenix P12 Monitor

A high quality data display monitor, ideal for all Nascom and Gemini systems. 20MHz resolution. Available in amber or green phosphor

£110
(£126.50 inc. VAT)

MICROVALUE DEALERS:

AMERSHAM, BUCKS
Amersham Computer Centre,
Oakfield Corner,
Sycamore Road.
Tel: (02403) 22307

BIRMINGHAM B5
Skytronics MBM, 80 Bristol Street,
Tel: 021-622 6436

BRISTOL
Target Electronics Ltd., 16 Cherry Lane.
Tel: (0272) 421196

COLCHESTER
Emprise Electronics Ltd.,
58 East Street.
Tel: (0206) 865926

EGHAM, SURREY
Electrovalue Ltd.,
28 St. Judes Road, Englefield Green.
Tel: (07843) 3603

IPSWICH
MDW (Electronics),
47/49 Woodbridge Road East.
Tel: (0473) 78295

LONDON W2
Henry's Radio, 404 Edgware Road.
Tel: 01-402 6822

LONDON SW11
OFF Records,
Computer House, 58 Battersea Rise,
Clapham Junction.
Tel: 01-223 7730

MANCHESTER M19
EV Computing, 700 Burnage Lane.
Tel: 061-431 4866

NOTTINGHAM
Computerama, (Skytronics Ltd.)
357 Derby Road.
Tel: (0602) 781742

Telephone orders welcome

BARCLAYCARD VISA

BUY FROM THE COMPUTER PROFFESSIONALS

MicroValue

REAL value — from the Professionals

BUSINESS NEWS

MIND YOUR BUSINESS ▶

Minding your business is now a lot easier with the advent of the Orion Total Business Management System being manufactuered in the UK by Future Technology Systems and supported by an extensive range of software from such leading houses as Peachtree Software International Ltd.

Orion is based on the Intel 8086 microprocessor with full 16 bit implementation supporting 128K of main memory expandable to 896K with an 8MHz clock and operates under enhanced versions of CP/M-86 and MP/M-86. The system can be easily upgraded and is user friendly, and can operate either as a stand alone work station or be in communication with other computers.

The starting price of the Orion system which includes 128K RAM, twin ½M floppy disc drives, screen, keyboard CP/M-86 operating system, operation and user manuals is £2950 excluding VAT. Further details can be obtained from Office and Electronic Machines Plc, 140-154 Borough High Street, London SE1 1LH.

CRA Corner

The February issue of ***Computing Today*** was the first edition in which the 'CRA Corner' appeared. Not unnaturally it was taken up almost entirely with explaining the objectives of the Computer Retailers Association.

It is appropriate that readers should consider for a minute, the importance of the fact that a magazine of the stature of ***Computing Today*** has, of its own volition, provided to the CRA space in which to comment upon various industry matters.

It is frequently forgotten, even by members of the industry, how young we all are. The year of 1978 is usually taken as the first year in which microcomputers came to the United Kingdom. Hence, the industry is only just over four years old. One wonders what other industries were like at such a young age. Without a doubt our industry has made a lot of mistakes. A number of so called entrepreneurs thought that they could get on the bandwagon of success and make their fortunes. Only to find that selling microcomputers, and software for them, requires just as much business acumen as any other concern.

If 1978 was the start, then the latter half of 1982 and the beginning of 1983, will enter the history books as the time at which the industry came of age. A large number of the early dealers have ceased business and the ones that have survived are those with a professional approach to the merchandising of microcomputer products.

Magazines, although having a number of unique interests and features of their own, are basically businesses much the same as others. Like other concerns in the industry they have had their growing pains. Some have just been in it for the money. Being an Association of retailers, we are of course well aware of the necessity for profit. Whether one views it as a dirty word or not, it is the grease upon which the wheels of business turn. Magazines have had to make a profit just the same as any other business. Some, however, have considered this to be their only motive. They are, therefore, little different to the entrepreneur previously mentioned, who commences his business thinking he will make a fortune and having that aim as his sole intent.

We are, therefore grateful to ***Computing Today***, for by allocating space to a non-profit organisation dedicated entirely to maintaining and improving the standards of the industry, they have shown that their aims are the same as our own.

Next month we will explain the functions of the Computer Retailers Association with regard to customer/dealer relations and also the procedures to be followed in the case of any complaints.

A J Harding
The Computer Retailers Association
1 Buckhurst Road, Bexhill on Sea,
E Sussex.

SAMURAI ATTACK

Well we may all have to bow down before the new 16 bit microcomputer, the Samurai, which has been recently launched by Micro Networks. As with the Japanese Samurai warrior, the micro is claimed to have high standards of reliability, performance and service. Peachtree application software runs on the machine and is recommended. This covers all the usual business requirements, including accounting, word processing and financial modelling. The Samurai is compatible with the products of all other reputable software houses, providing an extensive range of specialist packages.

Aimed at the business user, the price for a standard system starts at £2,795 excluding VAT. Although Micro Networks plan to set up a network of a limited number of dealers, they are at present the exclusive distributors of the Samurai, so for more information you should write to them at 382-386 Kensington High Street, London W14 8NL or telephone 01-602 7405.

HOUSE YOUR COMMODORE

The Commodore 8032 and 8096 professional micros have been launched in new futuristic-style housing designed to conform to compulsory IEC specifications. The housing is made from rigid ABS plastic. At £995 for the 8032 (32K RAM) machine and £1195 for the 8096 (96K RAM) the 8000 series computers can benefit small or large businesses. The prices are excluding VAT.

Further information can be obtained from Commodore Business Machines (UK) Limited, 675 Ajax Avenue, Trading Estate, Slough, Berkshire SL1 4BG or 'phone 0753-74111.

CP/M FOR IBM

CP/M-86, the 16 bit version of CP/M, has been announced for the IBM Personal Computer by Digital Research. This version which costs as little as £42 is much cheaper than the IBM version and offers several enhancements, including a print spooler and a library of device drivers for the most popular

graphics printers, plotters and cards.

Further information can be obtained from Digital Research (UK) Limited, Oxford House, Oxford Street, Newbury, Berkshire RG13 1JB, or by 'phoning 0635-35304.

AND FOR DESSERT . . .

Apple have served up some new offerings by enhancing and extending their range of business and professional microcomputers. The Apple IIe has a new main logic board, keyboard, case design, a standard 64K RAM which of course can be extended. Almost all of the software for the existing Apple II plus is compatible with the new machine. The IIe is priced at £845 excluding VAT.

Lisa is the new product that Apple are very excited about. Six applications software packages are integrated into the micro designed for office professionals. The machines was designed with the nontechnical user in mind with simple pictures appearing on the screen that can be manipulated using the Mouse, a device for selecting the functions or objects desired without having to key a lot of instructions into the machine. The system is based on a Motorola 68000 microprocessor with up to 1M of main memory, plus 1.7M of internal and up to 10M of external disc capacity. A complete Lisa system including the main applications software, ProFile and Apple Dot Matrix Printer, will be priced around $12,000. Lisa will be distributed by a network of selected Apple dealers in the UK. Shipments will begin in Spring 1983 and quantity shipments of European versions are planned for the early Autumn 1983.

Further information can be obtained from Apple Computer (UK) Ltd, Eastman Way, Hemel Hempstead, Hertfordshire HP 7HQ, or by 'phoning 0442-60244.

For editorial comment on the new Apple range see #File in this issue

IBM GET PERSONAL ▲

Yes IBM have finally launched into the UK micro market with their Personal Computer which was originally produced in the North American market place in August 1981. Designed primarily for professionals, small business units, educational establishments and individuals, the computer is easy to use and can be expanded to meet growing needs.

The computer consists of four units: the system unit comprises a high speed 16 bit microprocessor with a user memory of between 64K and ½M, and includes a built-in speaker and houses up to two diskette drives; the keyboard is adjustable and has 83 keys; the printer prints in either direction at up to 80 characters per second in a variety of fonts; the display screen provides 25 lines of 80 positions.

The computer will be manufactured for customers in Europe, the Middle East and Africa in Greenock, Scotland. The minimum self-sufficient system including keyboard, 128K RAM, 160K diskette and monochrome display costs £2,080 and a typical larger system including keyboard, 128K RAM, two 320K diskettes, monochrome display and printer costs £3,442. The prices are excluding VAT and of course the separate units are individually priced so the above is only a guide. For more information contact IBM United Kingdom Limited, PO Box 41, North Harbour (Baltic House), Portsmouth PO6 3AU.

For editorial comment on the IBM Personal Computer see # File in this issue.

The Computerland store in Southampton has been named as one of the retail outlets that IBM plan to use to market its Personal Computer in the UK, which continues the role Computerland has had in the distribution of the IBM Personal Computer in the United States and Canada. Computerland's Southampton address is Spring Crescent, Portswood, Southampton SO2 1FZ.

Software News

INNOVATIVE
TRS 80·GENIE SOFTWARE

from the professionals

DATA-WRITER

Data-Writer approaches Database Management in an entirely different manner in that, subject to one or two requirements, it is not concerned as to how the database came about or the form of it. Indeed, one of the most attractive features of the program is that the data itself can even be written on a word processor — not by Data-Writer at all. So far as we have been able to ascertain, any word processor may be used that writes a plain ASCII file. Certainly AJEDIT and Scripsit are supported. If you do not have a word processor, or do not wish to use it for the manufacture of your database, then there are sections in Data-Writer which in themselves constitute mini word processors and enable the user to manufacture a database very easily.

In the foregoing paragraph we use the words "word processors" in the plural, and this gives a clue to a rather important feature of Data-Writer. The whole concept of the software is that it is a **Management** program. A number of earlier databases have suffered very seriously from what the author no doubt thought was economic writing, in that if a section of a program (for instance the word processing section) is used by a number of sections, only one is included and is accessed by various sections. At first sight this might indeed appear to be economic writing and we suppose in fact it is, but the result is that the disks are continually thrashing around as access is made to them. Disk access is probably the slowest task that the CPU carries out and if it is done frequently it slows the program down very considerably. Many past Database Management programs have suffered from this deficiency. Data-Writer on the other hand has a mini word processor in each section of the program where it is needed. This has the great advantage of obviating the necessity for the drives to be thrashing around, but almost as importantly means that the format of the mini word processor can be changed for the various sections of the program, so that the best advantage can be made of it in each. Thus every section is entirely separate and gives a very high degree of efficiency and user friendliness.

Data-Writer has a very powerful mathematical section whereby many complex mathematical functions can be carried out on your data. Up to 20 equations may be defined per run.

Data-Writer also contains a very powerful "Mail Merge" section. Almost any personalisation can be added to a letter or report, and once again the letter or report may be constructed either on the mini word processor provided in Data-Writer or by way of an external one.

The Sort is a two level one and supports the extraction of stipulated data from a field. It is what might be called of fair speed. The two key levels make it powerful but as the Select section is so good, the Sort does not get used as often as would be the case in other Databases.

Data-Writer is made up of 11 sections or sub-programs as follows:

Entry	Manage	Maths	Sort	Letters	Access
Edit	Statistics	Select	Labels	Reports	

The Select section is particularly important. This section enables you to create a sub-set of the database by selecting from the file contents. It is immensely powerful and supports nine equivalency relationships, such as "less than" or "greater than" etc. The two logical relationships AND and OR may be used freely.

Data-Writer is one of the most powerful Database Management systems that we have seen available for a microcomputer and certainly is the most powerful that we have seen for the TRS-80 and Video Genie machines. Once the database has been manufactured, either by Data-Writer or a word processor, one has complete and utter control over it and the ability to manipulate any part of it; not only the ones mentioned above, but many others which we have not had the space to list. Data-Writer is compatible with the Model I and Model III Tandy machine, the original Video Genie, together with the Genie I and II. A version for the Model III Genie will be available shortly.

Data-Writer is Compiled Basic, hence its DOS compatibility is dependent upon the compatibility of the Microsoft Compiler. Due to Microsoft's disinterest in supporting any other DOS apart from TRSDOS and the non availability of a Tandy Model III Compiler, we recommend customers to use Data-Writer with TRSDOS or LDOS on the Model I and the proprietary DOS supplied on Data-Writer for the Model III. Other DOS's may well be compatible after patching and as we have said the criteria is whether they are compatible with the Microsoft Compiler.

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SOFT WARES

BY JOVE! ▲

The first software for the Jupiter Ace has recently been announced. Called Peeker, it is designed to run on the unexpanded 3K Ace. It disassembles ROM and RAM in Decimal, Hex, ASCII, Character and Binary. The software has 20 bytes per screen, single key run on and an input start address in decimal or Hex. Peeker is available direct from Remsoft, 18 George Street, Brighton BN2 1RH at a price of £3.50 post paid.

APPLE PRESS

Dynatech have produced a number of updates and modifications for their program generator for Apple micros, CORP. In order to make it even easier to use, all CORP packages supplied from October 1st 1982 include a disc of sample programs to illustrate precisely how the generator works and the instruction manual has also been altered.

CORP allows an Apple II user to write his own programs without any previous knowledge of computer programming or technical jargon: all instructions are simply entered in English or any other Western language. Because of its ease of use, business programs, like stock control, invoicing or accountancy packages, can be prepared in three to four hours by a complete novice.

The new CORP package costs £249 and includes master disc, demonstration tutorial, two utility discs, and a diagnostic disc. All items, including the new additions, are also available separately. The demonstration tutorial disc costs £19, sample programs disc £19 and the revised manual £5. All are available directly from Dynatech Microsoftware, Summerfield House, Summerfield Road, Vale, Guernsey.

ENLISTING HELP

How else would you want to handle lists except with a filing program called 'List Handler'? The program not only stores and prints lists and labels but prints letters too. Designed for the Apple II, up to 3,000 records can be held so that 24,000 can be kept on-line with multiple disc drives. List Handler will run on one or two drives, work with any DIF format including VisiCalc and DB Master, has unlimited Sort fields and has the ability to read and write text files.

List Handler can stand alone or as a mailmerge interface with 'Word Handler', to make an extremely efficient text editing duo. List Handler can be used with virtually all other Apple word processors. If you want to know more, contact Pete & Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG, or 'phone 0706-227011.

SOFTLY, SOFTLY

Described as the 'thinking man's maze game', Maze Runner has been introduced recently by Kuma for the Sirius 1. The game involves the player exploring the maze inhabited by monsters who protect the treasure, and before you can kill the monsters, you have to pick up any of the swords that hang around the walls. The shields that abound unfortunately do not last too long and the swords are prone to breaking, so survival is not an easy business!

Up to four players can play with an easy start for the nontechnical — the disc auto loads. The price is £14.50 plus VAT and is available from Kuma and other Sirius dealers.

Also available from Kuma is their FIG-FORTH toolkit, consisting of a series of screens containing the definitions of FORTH words, and giving the user a variety of facilities which enhance the basic FIG-FORTH language for the Sharp MZ-80A and MZ-80K. The words supplied may be grouped as: General purpose words, Primitive keyword generation words, Graphics words, Music words, Time words, Utility words, and Demonstration programs. The toolkit is priced at £14.50 plus VAT.

For further information, contact Kuma Computers Limited, 11 York Road, Maidenhead, Berkshire SL6 1SQ, or 'phone 0628-71778.

SUCH FINESSE

Add finesse to your IBM Personal Computer, by using Microfinesse which provides the level of performance on the IBM micro that can normally only be found on mainframe systems. While promoted as a financial modelling program, its power and flexibility can be applied to manpower planning, production analysis etc. Features distinguishing Microfinesse from other programs include a menu driven system, 7,000 call availability, consolidation of data, sensitivity analysis, target search and investment analyses and a user defined menu structure. The retail price is £550 and further details are available from Ferrari Software Limited, 683 Armadale Road, Feltham, Middlesex TW14 0LW, or by 'phone on 01-751 5791.

ENTOMBED! ▲

Well it's not quite as grave as it might at first sound . . . The Tomb of Drewan is a new adventure game for the VIC. Featuring exciting graphics, the player can actually see himself as he collects spells and fights demons in his

search for the Amulet of Kartos. There are 400 chambers in the tomb and the action takes place on the screen one chamber at a time. Fast reactions and quick wits are vital to avoid wounds and loss of strength from attacks by the demons. Since a game could last for hours, it can be saved and loaded back in to be resumed at a later time.

The Tomb of Drewan is supplied in a presentation box with a full instruction manual. The program requires 16K expansion and is available for £12.95. If you are dying to get more information, write to Audiogenic Limited, PO Box 88, Reading Berkshire, or 'phone 0734-595647.

SPELLBOUND

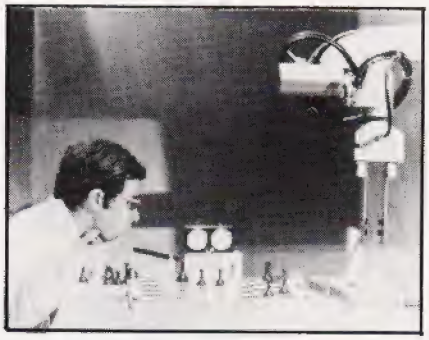
Spellbinder, the word processing package that is claimed to be the easiest to learn and the cheapest, now also acts as a calculator. This new feature allows the user to leave his text, carry out calculations, and then insert the results in the text if required. Also column totals or rows of figures in the text may be checked. Spellbinder has its own language and although it can be learned in 20 minutes it is designed so that the user can write his own programs as he becomes more confident.

The package includes in its price a host of programs aimed at handling most word processing applications, including mailmerge, sorting, forms design and paragraph insertion. Being one of the few systems that will drive a Sanders media printer, the cost of £275 includes assembler files of video and printer drivers, editing programs and manuals. For £200 you can purchase a fully interactive dictionary program which automatically 'proofreads' text and checks spellings against its 20,000 word dictionary. If you want more information on either product, contact Encotel Systems Limited, 7 Imperial Way, Croydon Airport Industrial Estate, Croydon, Surrey CR0 4RR, or 'phone 01-686 9687.

YOUR MOVE

Computers are very obliging chess partners, even if they're not always obliged to let you win! The number of available models however causes difficulty as interested chess players try to find their way through the chess computer jungle.

A report has now been produced giving details of the first UK ratings assessing the strength of chess machines. The assessment was based on advice from the British Chess Federation and was carried out in the first public tournament dedicated to chess



computers playing against chess players with BCF ratings. The 32 page report concentrates on the strongest chess computers and gives a full analysis of the Scisys Mark V, Fidelity Champion Voice Sensory and Applied Concepts Great Game Machine. Informative details are also given on the Mephisto 2, Fidelity Elite and the latest Fidelity releases, Prestige and Sensory 9.

Copies of the report can be obtained in writing from Chess Report, 1 The Mews, Hatherley Road, Sidcup, Kent DA14 4DX, stating your name and address and enclosing three 15½ postage stamps as a contribution towards the cost of postage and production.

GAMES PEOPLE PLAY

A wide variety of yet more games for people to play are available from Computer Games. You can move into the computer chess world with the new Sensory Chess Challenger 9, which has the ability to accept a library of add-on modules, programmed to vastly increase the computer's ability to play constantly improving chess. The first of two Sensory 9 cartridges available in the UK immediately expands the board's built-in 'library' of 3,000 book opening moves by some 9,000 moves, while the second gives an effective 27,000 more positions in total. Produced by Fidelity Electronics of Miami, Florida, the Sensory Chess Challenger 9 costs £149.95.

On a smaller scale is the Fidelity Mini Sensory Chess Challenger, measuring 8½" by 4½" by 1 ⅞". This machine is designed to help the beginner learn to play the game, but also provides an interesting opponent if you are already a chess player. A booklet entitled Let's Play Chess is provided, and the whole package is available from major department stores, and good toy and electrical shops at around £50, with additional plug-in modules for around £29.95.

Puck Monster is a hand held game that has nothing to do with a rogue ice hockey player! Aimed at the 7-14 year age group, the object is to gain as many points as possible with the three puckmen allocated to the player at the start of each game. Monsters are intent on eating your puckman as he wanders round a maze trying to eat food and energy capsules and become energised in order to eat the monsters. The game is further complicated when the puckman manages to eat all the food energy capsules, as the maze changes layout automatically. Puck Monster is available at most shops that sell toys and games and from many department stores. The price is £29.95 including VAT. A fast growing range of pocket and purse sized games from Computer Games is Games & Watch. These games include wide screen titles such as Parachute, Octopus, Popeye, Mickey Mouse, Fire, Turtle Bridge, Fire Attack and Snoopy Tennis and these retail at £19.95. Two multi screen titles are Donkey Kong and Oil Panic, priced at £23.95.

Five new Activision games are now available for the Atari Video Computer System: Starmaster, Barnstorming, Bridge, Ice Hockey and Chopper Command. The games can be obtained from most good high street stores and are priced at £24.95 including VAT.

Computer Games have also set up the CGL Activision Fun Club and consumers may write to the club at Freepost, Loughton, Essex, or 'phone 0628-32839/72448 to register for free membership.

Computer Games have a wide selection which is growing all the time so if you would like more information write to Computer Games Limited, CGL House, Goldings Hill, Loughton, Essex IG10 2RR, or 'phone 01-508

NEXT MONTH

computing today

MAY ISSUE ON SALE APRIL 8th

LIBRARY LUNACY

With almost annual precision the Sinclair Research organisation launch a new machine in the ZX series and, with equal gusto, the publishing industry falls over its own feet in the rush to produce books for the latest offering. This year being no different we have been inundated with lorry loads of books for the ZX Spectrum and, as a service to humanity in general, decided to do one of our mammoth book surveys. So, if you are looking for a book on or about the ZX Spectrum you should be able to find a review of it in our next issue. Unless, of course, someone has brought out yet another

A MICRO FROM DELPHI

Well, it actually acquired its name from a certain box of Blake's Seven but I prefer the classical connection myself. The Oric certainly looks neat enough in those glossy ads but what's it really like? After initial delays in production and delivery the system looks set to make a big entrance on the High Street computing front following its acceptance by W H Smiths.

Armed with machine and manual our reviewer disappeared for several weeks to fathom out its inner secrets. The results of his tests certainly make interesting reading, nay essential, for anyone proposing to buy a system for around £150.

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

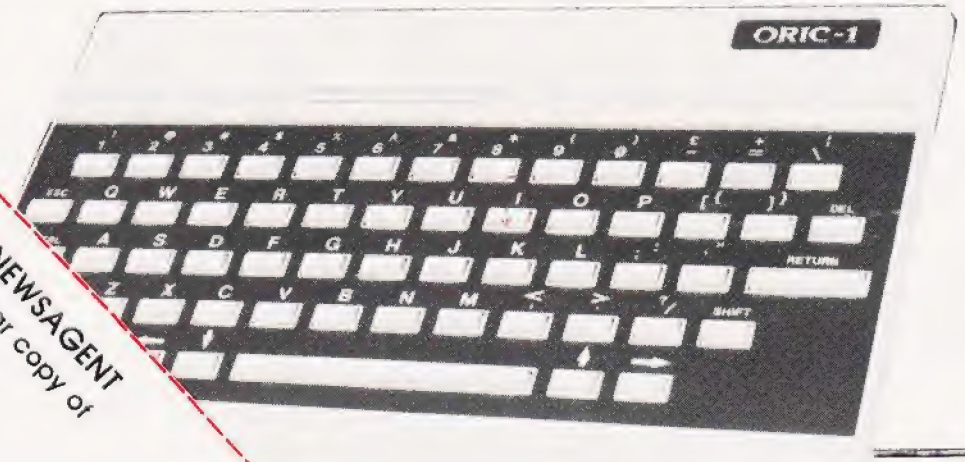
BUYING A MICRO?

Whether you are contemplating the purchase of your first system or the upgrading of your current machine the one thing you really need is information. Adverts and brochures are fine but what does the information actually mean to you, the user?

In our May issue we'll be presenting a special Buyer's Guide section where all the information you really need will be on show. Our compilers have reduced that mass of information into clear and concise terms, enabling you to make direct comparisons between the various machines in your price range. So, before you invest hundreds of pounds in your new computer why not invest a mere 80p and buy the next issue of Computing Today?

A JOKER IN THE PACK?

As far as the personal micro market goes the Jupiter Ace is certainly the odd one out as it doesn't use that most common of languages, BASIC. In keeping with recent trends the system uses FORTH as its native language which is different for a start! The other intriguing thing about it is its relationship to the ZX Spectrum in that its two designers were responsible for both machines. So, just how good is it and does the fact that it uses a 'non-standard' language make any difference? Well, for our report you'll have to read the May issue, won't you!



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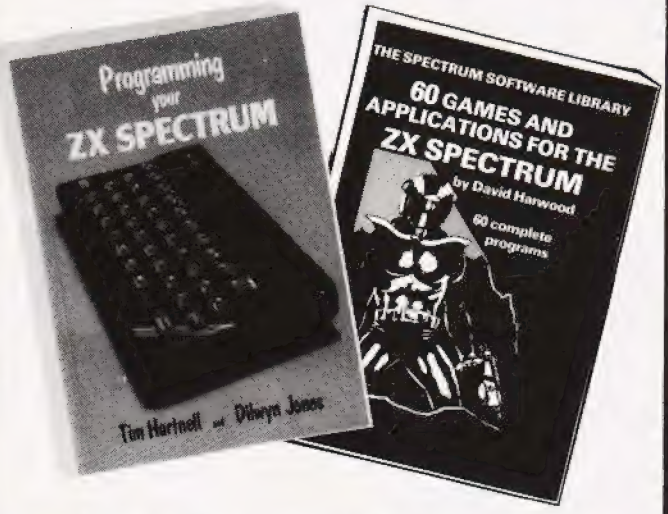
SPECTRUM



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Alan Heal

NASPEN APPEND

If you do a lot of work with ZEAP and wish that you could link the files to a text processor such as Naspen for documentation then this is what you need.

The following program is a utility which allows users of the ZEAP assembler for NASCOMs to append their source files to the Naspen text editor. Why, you may ask, would you want to do this? Well, whilst ZEAP is an excellent assembler it doesn't allow you to document your listings to the extent that you may require; adding comments and explanations of sections of the program for example. With the aid of this utility you can prepare and test the program, transfer a copy of it to Naspen, add comments and perhaps a covering letter and supply a fully documented printout.

HOW TO USE IT

If your ZEAP program is of a reasonable size the first thing to think about is the starting address. Normally you would start it at 2000 Hex but this can be changed by altering the contents of location F00 Hex to, say, 5000 Hex provided, of course, you have this much memory. The reason for doing this first is that we do not wish the ZEAP program to occupy the same area of memory as the Naspen file.

Now, warm start ZEAP and either type in or load from tape the source file you wish to convert to Naspen format. Once it is loaded return to NAS-SYS and cold start Naspen by typing:

```
E B800 <Enter>
```

If you already have a text file that you wish to join to the ZEAP file this should now be typed in or loaded from tape. If, on the other hand, you just wish to turn the ZEAP file into a Naspen file simply start Naspen up but don't enter any text.

Now, to join the two files together we must return to NAS-SYS and load in the program given below. Once loaded, execute the program and then warm start ZEAP. Any ZEAP output which would normally be sent to the serial interface or the UART will now be attached to the end of the Naspen file. This can be achieved by typing:

```
U N M <Enter>
```

and the ZEAP source file will be appended onto the end of the Naspen file using the format of the 'V M N' command which produces a 'listing' from line M to line N.

If the assembler option is used the object code will also be appended as well as the source file and a command of the following type will achieve this:

```
+ 4 <Enter>
```

then:

```
A M N <Enter>
```

where M and N are optional parameters to assemble from line M to line N. In this case both the source and object code will be appended to the Naspen file.

The final option available is to append the symbol table in addition to the source and object code. This can be achieved by entering:

```
+ 80 <Enter>
```

followed by:

```
A M N <Enter>
```

The Naspen file can now be stored, modified and printed as normal.

```
                        0010  ;APPEND ZEAP FILES ONTO NASPEN FILES
                        0020  ;ALAN HEAL
                        0030
0C80                    0040          ORG  0C80
                        0050
                        0060  ;EQUATES
0C80 0F 05              0070  PRTREF  EQU  0F05
0C80 10 1A              0080  ETPTR   EQU  101A
0C80 00 FF              0090  ETM     EQU  00FF
0C80 00 5B              0100  ZMRET   EQU  5B
0C80 00 0A              0110  LF      EQU  0A
                        0120
0C80 21 88 0C           0130  START   LD   HL,PRINT
0C83 22 05 0F           0140          LD   (PRTREF),HL
0C86 DF 5B              0150          SCAL ZMRET
                        0160
0C88 FE 0A              0170  PRINT   CP   LF
0C8A C8                 0180          RET  Z
0C8B E5                 0190          PUSH HL
0C8C 2A 1A 10           0200          LD   HL,(ETPTR)
0C8F 77                 0210          LD   (HL),A
0C90 23                 0220          INC  HL
0C91 22 1A 10           0230          LD   (ETPTR),HL
0C94 36 FF              0240          LD   (HL),ETM
0C96 E1                 0250          POP  HL
0C97 C9                 0260          RET
```

The assembly code listing for the utility program.

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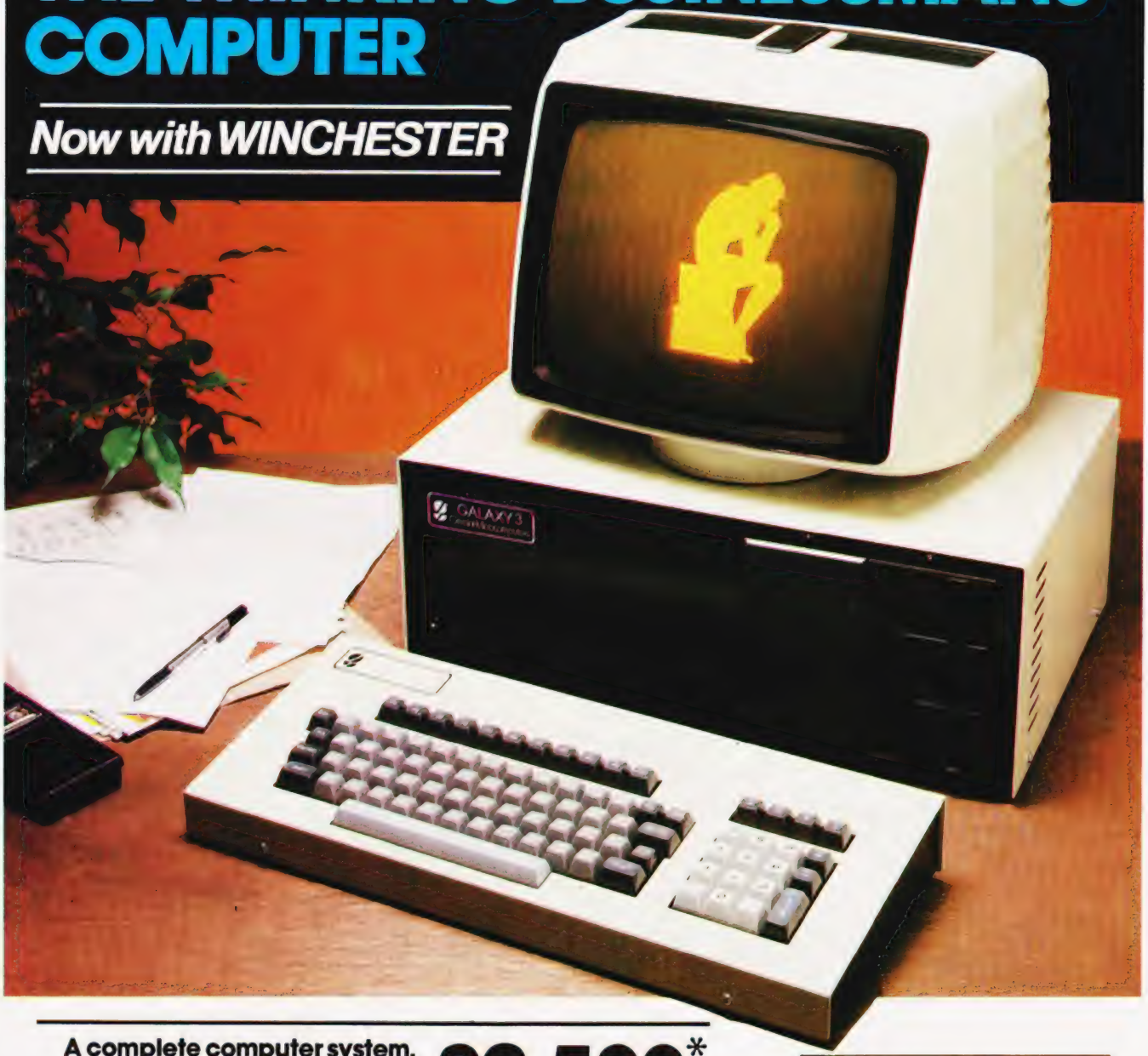

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Three out of every four computers going into schools are BBC Micros. Is there a lesson to be learned by every user?

As part of the current government subsidised scheme aimed at introducing micros to schools, the Department of Industry undertook a survey of machines available and made recommendations to education authorities all over the country.

The BBC Micro met their priorities exactly: it is economical yet fast and powerful, and it can justify the investment involved, through its capability to grow with the needs of the user and with the rapid changes in technology.

Teachers and education authorities agreed, and today it represents over three-quarters of all micros being ordered for schools across the country under the DOI scheme.

The BBC's choice too.

In choosing a machine to put their name to for their massive Computer Literacy Project, the BBC had the same set of priorities as the DOI. The BBC Micro is now an integral part of that project, which includes books, software, courses and a number of major television series, one of which, "Making the Most of the Micro" is now being broadcast.

All this for only £399.

The BBC Micro is light and compact. It generates high resolution colour graphics, and is capable of synthesising music and speech using its own internal speaker. The keyboard uses a conventional layout and typewriter feel.

The most sophisticated version (called Model B) is available for only £399. (There is also a basic model available, the Model A, at £299.)

Designed to grow.

Last year the magazine "Which Micro?" said that the most attractive and exciting feature of the BBC Microcomputer was its 'enormous potential for expansion'.

This is indeed one of the features that sets it aside from the competition.

For example, as well as interface sockets to allow you to connect directly to a cassette recorder, and to your own television, you can also use video monitors, disc drives, printers (dot matrix and daisy wheel) and paddles for games or laboratory use.

You can also plug in ROM cartridges containing games with specialist application programs.

The Tube. A unique feature.

The Tube, which is unique to the BBC Micro, provides for the addition of a second processor via a high speed data channel. The possibilities are enormous. For example, the addition of a second

3MHz 6502 processor with 64K of RAM doubles processing speed. While a Z80 with 64K of RAM opens the door to a fully CP/M* compatible operating system, with all the benefits for business applications.

Linking up with other computers.

The BBC Micro also offers a facility of immense potential value to schools, colleges and businesses. It's called Econet® – a system which uses telephone cable to link with other BBC Micros. A number of machines can then share the use of expensive disc drive and printer facilities.

Make full use of Prestel & Teletext.

With special adaptors you will not only be able to turn your TV set into a Prestel terminal and Teletext receiver, but you can also take data and programs direct from these services. (The programs, which are known as telesoftware, are already being broadcast by BBC's Ceefax service.) This is another first for the BBC Micro.

BASIC plus.

A sophisticated version of BASIC has been chosen for the BBC Micro, which incorporates features normally found only in more advanced high level languages. However, there is also a facility allowing access through a simple command to another language – for example, PASCAL, FORTH and LISP.

*Trademark of Digital Research.

A full range of software.

Applications software for the BBC Micro already cover a very wide field. Packages covering games, education and business applications are available on cassette. All developed to the same high standards set by the hardware.

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How to buy your BBC Micro.

If you are a credit card holder and would like to buy a BBC Micro B, or if you would like the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy a Model B directly by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants, NN8 2RL.

All orders are despatched by fully insured courier and come complete with easy to follow 500 page User Guide and Welcome cassette.

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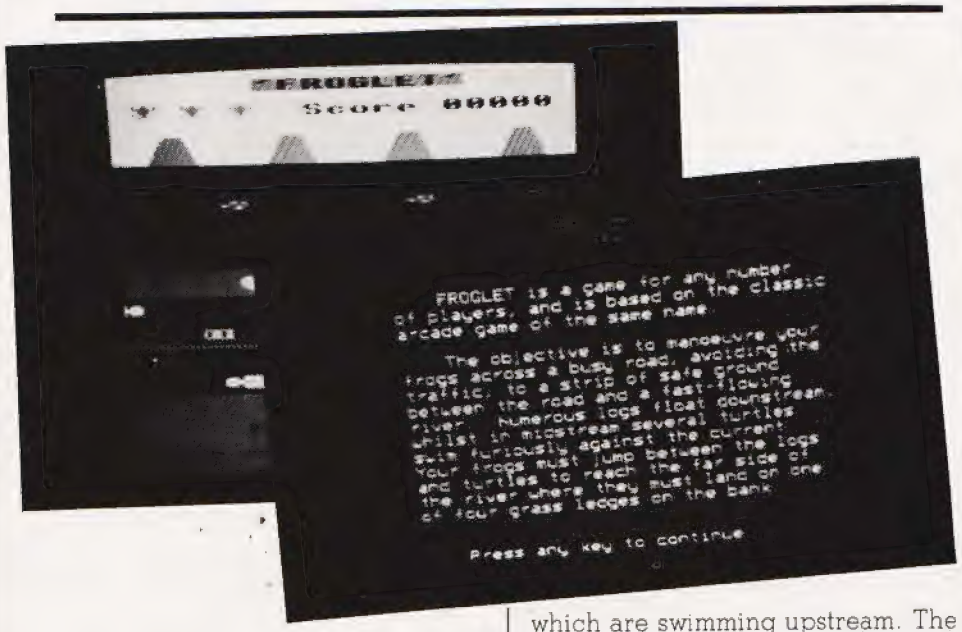
FROGLET

Hop on the bandwagon with our BBC Micro version of that arcade favourite, Frogger.



Arcade games have come a long way since the days of the first **Space Invaders** machines. Now that the novelty has worn off ones which mainly involve lots of cute little bug-eyed monsters for no very good reason, it makes a pleasant change to see games with a more original theme. One of my favourites is **Frogger,** in which you help a frog to cross a busy road and fast-flowing river whilst trying to avoid getting run over or being swept away by the current. Conservationists would, I am sure, approve.

A VERSION FOR AUNTIE

Listed below is a version of **Frogger** written on a 32K BBC Microcomputer. It consists of two programs, FROGLET and Froglet, which should be saved either on the same floppy disc, or consecutively on the same cassette.

In this version of the game you have three turns to get as many frogs as possible to safety. Whilst the computer plays the tune *Dixie* you must manoeuvre each kamikaze amphibian across four lanes of traffic onto a strip of safe ground between road and river. The frog must then cross the river by leaping between logs which are floating downstream, and turtles which are swimming upstream. The problem is that turtles have a nasty habit of going underwater, so to avoid being swept away by the current your frog should keep to the logs as much as possible. He finally reaches safety by hopping onto one of four grass ledges on the far bank of the river. A new frog then appears beside the road.

When three frogs are home a fly appears and starts buzzing around over the river. You get bonus points if your fourth frog lands on the fly during his journey. When four frogs have crossed the river the screen clears and you must repeat the procedure with four more. This time, however, the traffic, logs and turtles move faster than before, and the bonus for getting each frog across is increased accordingly.

The turn continues like this until a frog is killed or you take more than two minutes to complete a screen. After your three turns the computer displays a league table of the 10 best scores obtained during the current run. The table can be cleared at any time by pressing Escape and typing RUN.

GRAPHIC DETAILS

In order to understand how the programs work, you will need a rough idea of how the graphics are produced. Unfortunately, the speed requirements are such that the VDU drivers are too slow to move the traffic, logs and turtles around the screen by conventional methods. I have, therefore, been forced to use a machine code subroutine which writes directly to the Mode 2 screen memory. This technique is not to be recommended in general. Not only is it hellishly complicated but it also makes your program incompatible with the 'Tube'! However, its use here is justified by the 10-fold increase in speed which it produces.

The Froglet program regards the display as consisting of nine horizontal 'lanes' : lane 0 is the lane of traffic on the nearside of the road, lane 4 is the grass verge between road and river, and lane 8 is the furthest lane of the river. These nine lanes are animated by repeatedly redrawing them in the order stored in the index array called Lane%. To draw lane L ($0 \leqslant L \leqslant 8$) the computer executes a section of BASIC of the form:

```
!&70=&2DC0-48*I+D
!&72=S
CALL &2C00
```

where D is the distance (modulo 28) travelled by objects in lane L, and S is the screen RAM address starting at which the image of lane L is to be stored.

The machine code subroutine at location &2C00 has at its disposal two data tables (see Fig. 1). Table 1 comprises nine 48-byte strings, one string for each lane. these strings consist of bytes with ASCII values from 0 to 15 inclusive, where each of these 16 codes represents a special multi-coloured character, for example a tree or the front end of a racing car. Table 2 comprises 16 sets of 32 bytes. Each set is the 'memory image' of one of the multicoloured characters, ie it is what the computer stores in its screen memory when you print the character on the screen.

To see how the subroutine works let's consider an example of it being used. Suppose, for instance, that we want to draw the first lane of logs (lane 5) when the logs have floated a distance of 12 character-widths, and suppose that lane 5 starts at address &4900 in screen RAM. So we call the machine code routine as described above, with L = 7, D = 12 and S = &4900. It selects the string in Table 1 corresponding to lane 5 and finds that this consists of the following sequence of ASCII codes:

12, 12, 12, 1, 1, 1, 1, 1, 1, 12, 12, 12, 12, 1, 1, 1, 1, 1, 1, 1, 12, 12, 12, 12, 1, . . . ▶

where 1 represents a solid blue square, and 12 is the green/black section of a log on a blue background. The computer ignores the first 12 bytes and reads the next 20 bytes in the order 13 to 32 (these bytes represent the 20 characters of lane 5 which are to appear on the screen). On reading each of the 20 bytes the computer copies the corresponding character image from Table 2 to the screen memory. The first character image is copied to &4900–&491F, the second to &4920–&493F, and so on. Finally, an RTS command is executed and control returns to BASIC.

This rather complicated procedure results in the printing of lane 5 in less than 0.01 seconds, compared with 0.1 seconds using the VDU drivers.

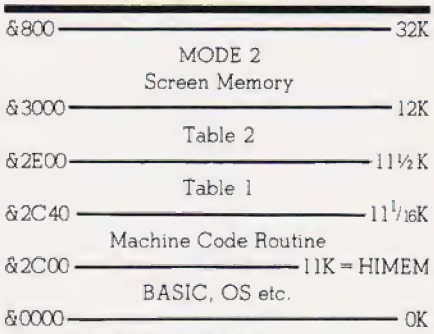


Fig. 1. Allocation of RAM.

DON'T RUSH JUST YET . . .

Since both programs are comparatively long, you are quite likely to make a few mistakes when typing them into your own machine. These notes should help you avoid, or at least recognise, the transcription errors which are most likely to occur.

Be careful when copying the DATA statements in both programs, particularly those in FROGLET. If on playing the game you find, for example, a lorry cab floating down the river or a tree speeding along the road, then you have made a mistake in lines 2310-2390 of FROGLET. On the other hand, if, for example, the front of every saloon car appears to have been drawn incorrectly then the fault lies between lines 2430 and 2740. An error in the data in Froglet will most likely manifest itself by making the computer play ***Dixie*** or the 'end of turn' jingle incorrectly.

The section of assembly language on lines 1380-1530 of FROGLET should be entered precisely as it is listed. Do not be tempted, for instance, to type STA &72,Y instead of STA (&72),Y — these two statements have quite different meanings.

THE PROGRAMS

To play the game you must first run the FROGLET program. This is given in Listing 1, and works as follows:

Line Number	Function
1000-1020	Title REMs.
1060-1130	Command lines to assign the function keys and cursor editing keys, to set colour flash rates and to clear the keyboard buffer.
1170-1210	Title page including copyright notice.
1250-1290	Envelope definitions and start up sound.
1330-1340	Character definitions : CHR$(224) = frog, CHR$(225) = fly.
1380-1530	Assembly of the machine code subroutine which is used to draw each 'lane' of the display.
1570-1640	Construction of Table 1, which defines the layout of the nine lanes of the display.
1680-1730	Construction of Table 2, which defines the appearance of each of the 16 special multicoloured characters.
1770-2220	Three pages of instructions.
2260-2270	Loads and runs Froglet.
2310-2390	Data for Table 1, with lanes in the order 8 down to 0. '@' means character 0, 'A' means character 1 etc.
2430-2740	Data for Table 2, with characters listed in the order 0 to 15. The characters are, respectively, black square, blue square, green square, lorry cab (pointing left), lorry body (left), cab (right), body (right), racing car (front), racing car (rear), saloon car (rear), saloon car (front), tree, log section, turtle's head, turtle's body, submerged turtle.

The game itself is contained in Froglet, and works as follows:

Line Number	Function
1000-1020	Title REMs.
2000-2030	Error trapping and initialisation of arrays Vel% and Lane%.
3000-3050	Title page.
4000-4020	Selection of Mode 2, alteration of HIMEM to prevent the corruption of the machine code routine and its data by the BASIC stack, initialisation of Score% ***et al.***
4030-4220	This is the main loop. The procedures which it calls are explained below.
4230-5030	End of game — draw table of best scores and check if another game is to be played.
6000-6220	PROCtable : constructs and displays the table of best scores.
7000-7140	PROCmove : checks if the movement keys have been pressed and alters the frog's position if necessary.
8000-8030	PROCtime : indicates how much time is left on a scale at the bottom of the screen.
9000-9030	PROCscore : displays the player's score at the top of the screen, together with the number of lives remaining.
10000-10030	PROCfrog : draws the frog at the appropriate position
11000-11040	PROClane(L%) : uses the machine code subroutine to draw lane L% of the display.
12000-12070	PROCbase : tells the player that his frog has reached the far side of the river successfully, and makes a new frog appear by the road.
13000-1370	PROCcheck : checks if the two minutes time limit has passed or the frog has been killed. If so the 'end of turn' flag, End%, is set to −1.
14000-14050	PROCmsg(X$,X) : prints the string X$ at the bottom of the screen and waits for X seconds.
15000-15250	PROCsetup : gets ready for the next group of four frogs to be manoeuvred across road and river. The screen is completely redrawn, the distances travelled by objects in each lane are randomised, and various variables such as the frog's position are reset.
16000-16070	PROCfly : moves the fly around over the river and makes an appropriate buzzing noise.
17000-17070	PROCtune : plays the next five notes of ***Dixie*** or the 'end of turn' jingle.
18000-18020	PROCsplosh : sound effect of frog falling into the river.
19000-19030	PROCdive : sound effect of frog falling from a great height.
20000-20050	PROCoops : sound effect of frog meeting an unpleasant end.
21000-21030	PROCfin : plays the 'end of turn' jingle.
22000-22040	PROCgulp : sound effect of fly being swallowed.
23000-23010	Data : direction of motion of objects in each lane and the order in which the lanes are to be moved.
24000-24040	Data : how to play ***Dixie***. See PROCtune to find out how each five-note string is decoded.
25000	Data : how to play the 'end of turn' jingle.

If you find that Froglet keeps printing 'O.K.' and stopping when you run it, then there is probably a syntax error somewhere. Type P.ERL:REPORT to find out where and what the problem is.

Finally, note that Froglet uses several variables with very similar names, so, for example, do not confuse x% with X%.

```
1040 REM *** Command Lines ***
1050
1060 *KEY 0 "|K"
1070 *KEY 1 "|J"
1080 *KEY 8 "|H"
1090 *KEY 9 "|I"
1100 *FX 4,1
1110 *FX 9,10
1120 *FX 10,5
1130 *FX 15,1
1140
1150 REM *** Titles etc. ***
1160
1170 MODE 7:VDU 23;8202;0;0;0;
1180 Title$=CHR$(130)+CHR$(136)+CHR$(141)+"'FROGLET'"
1190 PRINT TAB(11,9)Title$'TAB(11)Title$
1200 PRINT''TAB(8)CHR$(131)"by Simon T Ainsworth"
1210 PRINT'TAB(3)CHR$(131)"Copyright @ ASP Ltd MCMLXXXII"
1220
1230 REM *** Envelope Definitions ***
1240
1250 ENVELOPE 1,2,1,-1,1,1,2,1,100,-1,-3,-1,100,60
1260 ENVELOPE 2,1,0,2,3,10,20,10,100,-5,-5,-1,127,9
1270 ENVELOPE 3,2,129,65,33,50,40,30,100,-1,-2,-1,127,20
1280 ENVELOPE 4,2,127,-1,-2,1,50,50,100,0,-2,-2,127,80
1290 SOUND 3,3,40,100
1300
1310 REM *** Character Definitions ***
1320
1330 VDU 23,224,153,189,255, 60, 60,153, 90, 36
1340 VDU 23,225, 36, 24, 90,255,255,255,255, 90
1350
1360 REM *** Machine Code Routine ***
1370
1380 HIMEM=&2C00
1390 FOR I%=0 TO 1
1400   P%=&2C00
1410   COPT 2*I%
1420   LDY #0
1430   .Lb11
1440   LDA #&E0:STA &74:LDA #&2D:STA &75
1450   LDA (&70),Y:TAX
1460   .Lb12
1470   LDA #&20:CLC:ADC &74:STA &74:LDA #0:ADC &75:STA &75
1480   DEX:BPL Lb12:STY &76:LDY #&1F
1490   .Lb13
1500   LDA (&74),Y:STA (&72),Y:DEY:BPL Lb13:LDY &76
1510   LDA #&20:CLC:ADC &72:STA &72:LDA #0:ADC &73:STA &73
1520   INY:CPY #20:BNE Lb11:RTS:]
1530   NEXT
1540
1550 REM *** First Table used by Machine Code ***
1560
1570 FOR I%=0 TO 8
1580   READ Lane$:Lane$=Lane$+LEFT$(Lane$,20)
1590   Base%=&2C40+I%*&30
1600   FOR J%=0 TO 47
1610     ?(Base%+J%)=ASC(MID$(Lane$,J%+1,1))-64
1620     NEXT
1630   NEXT
1640 !&2C73=&01010F01:!&2C80=&01010F01
1650
1660 REM *** Second Table used by Machine Code ***
1670
1680 FOR I%=0 TO 63
1690   READ CharCode$
1700   FOR J%=0 TO 7
1710     ?(&2E00+I%*8+J%)=EVAL("&"+MID$(CharCode$,1+2*J%,2)
1720     NEXT
1730   NEXT
1740
1750 REM *** Instructions ***
1760
1770 CLS:PRINT TAB(11)Title$'TAB(11)Title$'
1780 PRINT'"    FROGLET is a game for any number"
1790 PRINT "of players, and is based on the classic"
1800 PRINT "arcade game of the same name."
1810 PRINT'"    The objective is to manoeuvre your"
1820 PRINT "frogs across a busy road, avoiding the"
1830 PRINT "traffic, to a strip of safe ground"
1840 PRINT "between the road and a fast-flowing"
1850 PRINT "river.  Numerous logs float downstream,"
1860 PRINT "whilst in midstream several turtles"
1870 PRINT "swim furiously against the current."
1880 PRINT "Your frogs must jump between the logs"
1890 PRINT "and turtles to reach the far side of"
1900 PRINT "the river where they must land on one"
1910 PRINT "of four grass leages on the bank."'
1920 PRINT'"    Press any key to continue..."
1930 G%=GET:VDU 28,0,23,39,4,12
1940 PRINT "    To make the game more difficult"
1950 PRINT "some of the turtles have a penchant"
1960 PRINT "for underwater swimming.  If you"
1970 PRINT "are on a turtle when it dives you"
1980 PRINT "will be swept away by the strong"
1990 PRINT "current, so be careful."
2000 PRINT'"    You get three turns per game."
2010 PRINT "In each turn you have two minutes"
2020 PRINT "to manoeuvre four frogs across the"
2030 PRINT "river - if you manage this then the"
2040 PRINT "game speeds up and you have a further"
2050 PRINT "two minutes to repeat the procedure."
2060 PRINT "The turn continues until a frog is"
2070 PRINT "killed or you reach the time limit."'
2080 PRINT'"    Press any key to continue..."
2090 G%=GET:VDU 28,0,23,39,4,12
2100 PRINT "    You score points mainly by getting"
2110 PRINT "your frogs across the river, but you"
2120 PRINT "also get bonus points for skilful"
2130 PRINT "manoeuvring, for reaching the time"
2140 PRINT "limit without killing off any frogs,"
2150 PRINT "and for catching flies which buzz"
2160 PRINT "around over the river once you get"
2170 PRINT "three frogs across."
2180 PRINT'"    You move the frogs by pressing"
2190 PRINT "the red function keys - press f0/f1"
2200 PRINT "to move up/down, and f8/f9 to move"
2210 PRINT "left/right.  Alternatively, you may"
2220 PRINT "use the grey cursor control keys."
2230
2240 REM *** Chain to Main Program ***
2250
2260 VDU 28,13,22,39,21
2270 CHAIN "Froglet"
2280
2290 REM *** Lane Layouts ***
2300
2310 DATA AAAALLLLAAAAAALLLLAAAAAALLLA
2320 DATA AAAMNAAAAAAMNAAAMNAAAAAAMNAA
2330 DATA AAAAAAALLLAAAAAALLLAAAAAALLL
2340 DATA LLLAAAAAALLLLAAAAAAALLLLAAAA
2350 DATA BBBBBBBKBBBBBBBBBKKBBBBBBBBB
2360 DATA @@@@IJ@@FFFE@@@@@@@FFFE@@@@@
2370 DATA @@@@@@@IJ@@@@@@@IJ@@@@@@@@IJ
2380 DATA @@@@CH@@@@@@CH@@@@@@@CH@@@@@
2390 DATA CDD@@@@@@CDDD@@@@@@CDDD@@@@@
2400
2410 REM *** Multi-Coloured Character Definitions ***
2420
2430 DATA 0000000000000000,0000000000000000
2440 DATA 0000000000000000,0000000000000000
2450 DATA 3030303030303030,3030303030303030
2460 DATA 3030303030303030,3030303030303030
2470 DATA 0C0C0C0C0C0C0C0C,0C0C0C0C0C0C0C0C
2480 DATA 0C0C0C0C0C0C0C0C,0C0C0C0C0C0C0C0C
2490 DATA 0000050505050000,000F3F3F3F3F0F00
2500 DATA 000F3F3F3F3F0F00,00151153F3F151500
2510 DATA 3F3F3B37373B3F3F,3B373F3F3F3F373B
2520 DATA 3F3F3E3D3D3E3F3F,3E3D3F3F3F3F3D3E
2530 DATA 002A2A3F3F2A2A00,000F3F3F3F3F0F00
2540 DATA 000F3F3F3F3F0F00,00000A0A0A0A0000
2550 DATA 3D3E3F3F3F3F3E3D,3F3F3D3E3E3D3F3F
2560 DATA 373B3F3F3F3F3B37,3F3F373B3B373F3F
2570 DATA 0000000000000000,0100103030100001
2580 DATA 0320303030302003,0000303030300000
2590 DATA 0000303535300000,0310303030301003
2600 DATA 0200202020200002,0000000000000000
2610 DATA 0000000000000000,0016163C3C161600
2620 DATA 003C34343434C00,003C3C3C3C3C3C00
2630 DATA 003C383838383C00,003C3C3C3C3C3C00
2640 DATA 000A282828280A00,0000000000000000
2650 DATA 0C0D0D0F0D0D0C0C,0F1B0F270F1B0F0D
2660 DATA 0E0F0F1B0F0F0E0E,0C0E0E0E0E0C0C0C
2670 DATA 3000040000000000,0000001000080000
2680 DATA 1800000000000830,3000000800000030
2690 DATA 3030303030303030,3030200C0C203030
2700 DATA 2430180C0E183024,1B240D0C0C0C2418
2710 DATA 300C0C0C0C0D0C30,24180D0C0C0C1824
2720 DATA 1B3030181830301B,3030303030303030
2730 DATA 3035303830303530,3430240C0C243030
2740 DATA 3030180E0C183038,303A303034303A30
```

Listing 1. The initial FROGLET program.

```
2000 ON ERROR VDU 22,7:PRINT''''"O.K."':END
2010 DIM Ptr%(8),Vel%(8),Lane%(10),Player$(10),Score%(10)
2020 FOR I%=0 TO 8:READ Vel%(I%):NEXT
2030 FOR I%=0 TO 10:READ Lane%(I%):NEXT
2040
3000 MODE 7:HIMEM=&2C00:VDU 23;8202;0;0;0;
3010 Title$=CHR$(130)+CHR$(136)+CHR$(141)+"'FROGLET'"
3020 PRINT TAB(11,9)Title$TAB(11)Title$
3030 *FX 15,1
3040 PRINT TAB(4,18)CHR$(134)"Press any key to start game"
3050 SOUND 3,2,0,1:G%=GET
3060
4000 MODE 2:HIMEM=&2C00
4010 VDU 23;8202;0;0;0;19,9,7;0;19,15,7;0;
4020 Score%=0
4030 FOR Turn%=1 TO 3
4040   Screen%=0
4050   REPEAT
4060     PROCsetup
4070     REPEAT
4080       FOR I%=0 TO 10
4090         L%=Lane%(I%)
4100         IF ADVAL(-7)=15 PROCtune
4110         Ptr%(L%)=(Ptr%(L%)+Vel%(L%)+28) MOD 28
4120         PROClane(L%)
4130         Time%=TIME+6-2*Screen%
4140         REPEAT UNTIL TIME>Time%
4150         IF L%=y% PROCfly
4160         IF L%=Y% PROCfrog
4170         IF End%=0 AND (L% MOD 2) PROCmove
```

```
4180          NEXT
4190        IF End%=0 PROCtime
4200        UNTIL End%
4210      UNTIL Frog%<4
4220    NEXT
4230 PROCmsg("You Scored "+STR$(Score%),3)
4240
5000 MODE 2:HIMEM=&2C00
5010 PROCtable
5020 COLOUR 6:PRINT TAB(3,27)"Another Game?"
5030 IF (95 AND GET)=78 ABORT ELSE 4000
5040
6000 DEF PROCtable
6010 IF Score%<Score%(10) GOTO 6140
6020 COLOUR 6:PRINT TAB(1,13)"What is your name?"
6030 COLOUR 7:INPUT TAB(6,16) Player$
6040 IF LEN(Player$)<13 GOTO 6070
6050 COLOUR 9:PRINT TAB(2,19)"Sorry - Too long"
6060 PROCoops:K9%=INKEY(250):CLS:GOTO 6020
6070 CLS:Rank%=11
6080 REPEAT Rank%=Rank%-1
6090   UNTIL Rank%=1 OR Score%(Rank%-1)>Score%
6100 FOR I%= 10 TO Rank%+1 STEP -1
6110   Player$(I%)=Player$(I%-1):Score%(I%)=Score%(I%-1)
6120   NEXT
6130 Player$(Rank%)=Player$:Score%(Rank%)=Score%
6140 VDU 23;8202;0;0;0;
6150 COLOUR 10:PRINT TAB(4,2)"Best Scores"''
6160 GCOL 0,10:MOVE 240,920:DRAW 960,920
6170 FOR I%=1 TO 10
6180   COLOUR (I% MOD 7)+1
6190   PRINT;I%;TAB(3);Player$(I%);
6200   PRINT TAB(15);RIGHT$("0000"+STR$(Score%(I%)),5)
6210   NEXT
6220 ENDPROC
6230
7000 DEF PROCmove
7010 G%=127 AND INKEY(0)
7020 IF G%<8 OR G%>11 ENDPROC
7030 SOUND 3,2,0,1
7040 *FX 15,1
7050 X=X%:X%=X%+(G%=8)-(G%=9)
7060 Y=Y%:Y%=Y%+(G%=10)-(G%=11):IF Y%<-1 Y%=-1:G%=9
7070 PROClane(Y)
7080 PROCcheck
7090 IF End% ENDPROC
7100 IF Y%=9 PROCbase:ENDPROC
7110 IF G%=0 Bonus%=50 ELSE IF G%=1 Bonus%=-25 ELSE Bonus%=10
7120 Score%=Score%+Bonus%
7130 PROCscore
7140 ENDPROC
7150
8000 DEF PROCtime
8010 PROCcheck
8020 GCOL 0,2:MOVE 320,64:DRAW 320+TIME/13.38,64
8030 ENDPROC
8040
9000 DEF PROCscore
9010 COLOUR 131:COLOUR 0
9020 PRINT TAB(14,3);RIGHT$("0000"+STR$(Score%),5)
9030 ENDPROC
9040
10000 DEF PROCfrog
10010 IF Y%>4 X%=X%-Vel%(Y%)
10020 PROCcheck
10030 ENDPROC
10040
11000 DEF PROClane(L%)
11010 IF L%<0 VDU 17,130,31,0,26:PRINT SPC(20):ENDPROC
11020 !&70=&2DC0-L%*&30+Ptr%(L%)
11030 !&72=&6C00-L%*&500:CALL &2C00
11040 ENDPROC
11050
12000 DEF PROCbase
12010 PROClane(8)
12020 Frog%=Frog%+1:IF Frog%=4 End%=TRUE
12030 VDU 17,130,17,9,31,X%,6,48+Frog%
12040 Y%=-1:Score%=Score%+500*(Screen%+1):PROCscore
12050 VDU 17,15,17,130,31,X%,26,224
12060 SOUND 3,3,0,20
12070 ENDPROC
12080
13000 DEF PROCcheck
13010 P%=POINT(64*X%+32,64*Y%+240)
13020 Q%=POINT(64*X%+96,64*Y%+240):Q%=(P%=3 OR Q%=3)
      AND (Y%=7)
13030 IF P%=13 PROCgulp
13040 VDU 5,18,0,15,31,X%,24-Y%*2,224,4
13050 IF TIME>12000 PROCmsg("Time's Up",2):Score%=
      Score%+250:GOTO 13150
13060 IF P%=0 OR P%=2 OR P%=13 OR P%=15 ENDPROC
13070 IF P%<0 PROCmsg("You Went Off Screen",0):PROCdive:
      PROCoops:GOTO 13150
13080 IF Y%<4 PROCmsg("You Got Run Over",0)
13090 IF Y%=4 PROCmsg("You Hit A Tree",0)
13100 IF P%=9 PROCmsg("You Can't Do That!",0)
13110 IF Y%<5 OR P%=9 PROCoops:GOTO 13150
13120 IF Q%<0 PROCmsg("The Turtle's Dived",0):PROCdive
13130 IF Y%=9 PROCmsg("You Hit The Cliff",0):PROCoops:
      PROCdive
13140 PROCmsg("Your Frog Fell In",0):PROCsplosh
13150 PROCscore:PROCfin:K9%=INKEY(100)
13160 End%=TRUE:I%=10
13170 ENDPROC
13180
14000 DEF PROCmsg(X$,X)
14010 VDU 17,130,17,4,31,0,28
14020 PRINT SPC(10-LEN(X$)/2) X$ SPC(20-POS)
14030 *FX 15,1
14040 K9%=INKEY(100*X)
14050 ENDPROC
14060
15000 DEF PROCsetup
15010 VDU 28,0,24,19,18,17,128,12
15020 VDU 24,0;784;1279;1023;18;131,16,24,0;528;1279;
      783;18;132,16
15030 VDU 24,0;464;1279;528;18;130,16,24,0;0;1279;207;
      18;130,16,26
15040 VDU 17,130,17, 8,31,6, 1:PRINT "'FROGLET'"
15050 VDU 17,131,17, 0,31,8, 3:PRINT "Score"
15060 VDU 17,130,17, 4,31,0,30:PRINT "Time"
15070 VDU 17,130,17,15,31,9,26,224,17,131,17,2
15080 FOR I%=Turn% TO 3:VDU 31,2*I%-1,3,224:NEXT
15090 PROCscore
15100 GCOL 0,7:MOVE 0,335:PLOT 21,1280,335
15110 GCOL 0,0:MOVE 320,64:DRAW 1216,64
15120 GCOL 0,4:MOVE 1216,80:DRAW 1216,48:MOVE 320,
      48:DRAW 1216,48
15130 FOR I%=320 TO 1216 STEP 56
15140   MOVE I%,48:DRAW I%,40
15150   NEXT
15160 VDU 24,0;0;1279;850;18;2
15170 FOR I%=160 TO 1120 STEP 320
15180   MOVE I%-64,784:MOVE I%+64,784:PLOT 85,I%,890
15190   NEXT
15200 End%=0:Frog%=0:Screen%=Screen%+1
15210 X%=9:Y%=-1:x%=9:y%=6
15220 TIME=0:RESTORE 24000
15230 FOR I%=0 TO 8:Ptr%(I%)=RND(28):NEXT
15240 PROCmsg(MID$(" FirstSecond Third",Turn%*6-5,6)+"
      Turn",0)
15250 ENDPROC
15260
16000 DEF PROCfly
16010 IF Frog%<3 ENDPROC
16020 VDU 5,18;13,31,x%,24-2*y%,225,4
16030 SOUND 16,-10,7,25
16040 IF RND(6)>1 ENDPROC
16050 x%=(x%+2*RND(3)+16) MOD 20
16060 y%=5+((y%+RND(2)+1) MOD 4)
16070 ENDPROC
16080
17000 DEF PROCtune
17010 READ #&D00
17020 FOR J%=0 TO 8 STEP 2
17030   Freq%=4*(?(&D00+J%)-48):Len%=3*(?(&D01+J%)-48)
17040   IF Freq% SOUND 2,1,Freq%,Len% ELSE SOUND
        2,0,0,Len%
17050   NEXT
17060 IF ?&D09=52 RESTORE 24000
17070 ENDPROC
17080
18000 DEF PROCsplosh
18010 FOR J%=17 TO 30:SOUND 0,J%,5,3:NEXT:SOUND 0,31,5,20
18020 ENDPROC
18030
19000 DEF PROCdive
19010 SOUND 3,4,32,10
19020 K9%=INKEY(100)
19030 ENDPROC
19040
20000 DEF PROCoops
20010 SOUND 0,-15,3,25
20020 FOR I%=144 TO 100 STEP -1
20030   SOUND 1,0,I%,1
20040   NEXT
20050 ENDPROC
20060
21000 DEF PROCfin
21010 RESTORE 25000
21020 PROCtune:PROCtune
21030 ENDPROC
21040
22000 DEF PROCgulp
22010 Score=Score+750:PROCscore
22020 SOUND 3,17,96,3:SOUND 3,18,0,5
22030 x%=15*RND(2)-13:y%=5
22040 ENDPROC
22050
23000 DATA 1,1,-1,-1,0,-1,-1,1,-1
23010 DATA 0,6,3,8,1,4,7,2,6,1,5
23020
24000 DATA :171320032,0031517181,:200:200:2,72<200<200
24010 DATA <3:1<3:1<1,>1?1A1C6?1,:1?6:171:2,00:2527236
24020 DATA 00:2?2C2A2,?2<2?4<2A6,<2A6:2?2C2,A2?2<2>2?3
24030 DATA <1:272?272,0072547236,725682?2:2,C3?1A2?472
24040 DATA 3672568272,:2C3?1A2?4
24050
24060 DATA 08?2;100;1,=2:4?2@200
```

Listing 2. The main routines are provided by the second Froglet program.

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Henry Budgett

SPECIAL REPORT

Never ones to let a good idea go to waste, Sharp have introduced their new PC-1251 hand-held computer. For size it could almost out-Epson the Epson!

When Sharp first introduced their PC-1211 hand-held computer I subjected the review machine to several months of testing in just about every location I could think of. It performed flawlessly, even if a little slower than my usual machine. The only real drawback with the system was that, even with the optional printer attached, there was no way to store programs unless you also carried a cassette recorder of some sort with you. The second hand-held system from Sharp, the bigger and faster PC-1500, exhibited the same 'failing' although in this case the system did allow you to plug in extra memory and, therefore, hold bigger programs in the machine (or, of course, several smaller ones).

The obvious answer was to incorporate some sort of mass storage device into the cradle that held the printer and this is precisely what Sharp have done with their replacement for the PC-1211, the PC-1251. Officially shown for the first time at the Which Computer Show in January I was lucky enough to have got my hands on one a little early and tried it out over Christmas and the first weeks of the New Year.

THE FIRST SHOCK

The system arrived a matter of days after our review Epson and, on the most basic of levels, a comparison can actually be made between the two! While the HX-20 will grace the desk of any executive I suspect that the technicians, engineers and research staff of his company might actually go for the Sharp. The whole ▶

lot packs into a neat brown case some 330mm by 160mm by 55mm; manuals, power supply and all. The PC-1251 itself is a mere 134mm by 70mm by 12mm, extending to 205mm by 150mm by 24mm when clipped into the printer and cassette module.

The keyboard and display follow the established format of a miniaturised QWERTY layout plus numeric keypad and a single line display of 24 characters in a LCD strip. Indeed, the only major changes from the traditions set up by its two predecessors are that the ON/OFF and MODE buttons have been replaced by a slider switch to the right of the LCD strip.

This is one of the weaker points in the design as it is a little fiddly to use. The size of the individual keys on the alpha keyboards is, to say the least, tiny; each measures some 3.5mm square but they are usable and the interkey spacing is good enough to prevent double keying unless you happen to posess fingers like Mr Walls' excellent sausages! The numeric pad keys are bigger allowing the device to be used in calculator mode for those 'simple' calculations.

One extra feature, not previously encountered on a Sharp machine, has been added and this is a contrast control. A similar knob featured on the Casio FX-702P I tested some while ago and I'm afraid that, once again, I found it of limited use. This control is situated on the right-hand side of the PC-1251, just below the equally fiddly slider switch — still I suppose if you are going to make mistakes you might as well put them all together! On the left-hand side of the case is the 11-way socket that connects the system into the printer/microcassette module. The underside holds little except the two screws which allow you access to the battery compartment and the All Reset button. This latter has been a feature of all the Sharp hand-helds and is intended to allow the student to have his memory erased before entering an exam room!

DON'T DO IT

Gaining access to the interior of the machine is simple, just unscrew the two miniature crossheads and the base plate can be carefully lifted up to get at the battery compartment. This holds two 3 V Lithium cells which should give some 300 hours of use on their own; the PC-1251 will also take power from the printer/cassette module which will extend the life of the internal batteries considerably. At this point you may be tempted, despite the manufacturer's warnings, to explore further. Take it from someone who knows better DON'T!

From the front to the back the case is made up of a number of layers, each of which has to be very precisely aligned with the next in order for the whole to operate correctly. The first layer is the keyboard membrane, a rubber sheet with a raised dimple that sits under each key of the keyboard. When any key is pressed this dimple flattens so that the conductive dot on the underside of the dimple is pressed against a set of gold 'finger' contacts on the main PCB.

The main PCB holds the LCD display, two large ICs and a mere sprinkling of other components. Quite what each device is I cannot say as the part numbers seem to bear no relationship to anything I've met before but at a guess I'd say that one of them looked after the main processing and the other was a specialised LCD controller — there is not a lot else they could be really! With all the tiny keys carefully replaced under their rubber sheet and the main PCB re-instated (carefully turns case over to make sure that the keyboard still makes sense) we are left with the problem of how to connect the lower PCB to the smaller one at the top. The only wires in evidence are the pair that connect to the piezo 'loudspeaker' so how the heck do those boards connect to one another? By now one is beginning to panic ever so slightly. Visions of having to contact the awfully nice people in Manchester and explain that one has had a slight accident with their new baby keep coming to mind but a third search through the few remaining components reveals that what I had previously thought to be a piece of rubber packing was in fact a very clever ribbon connector. Imagine, if you will, a piece of clear flexible plastic about 3mm square and 25mm long. Now insert conductive fibres through the block from one side to another, just like the wires in a ribbon cable but much finer. This block is now gently compressed between the gold plated edge connectors of the two main circuit boards and carries the various signals between them. The power is carried by a gold spring at each end of the block and that's it.

With that problem solved the rest of the system was re-assembled and is still giving perfect service. That second PCB which gave all the problems holds just three ICs, as far as I can tell two are RAMs and the other is a ROM but this doesn't explain how the PC-1251 looks after its I/O functions. I suspect that either the main CPU has an on-board I/O port or, less likely, all the necessary decoding etc is done in the printer/cassette module.

THE MAJOR PART

By far the biggest part of the system is the printer/cassette module, yet even this is small by everyone else's standards. Once again the insides are best left well alone and, as the unit is Ni-Cad powered you have no need to poke about under the lid anyway! Apart from the microcassette mechanism — exactly the same as used on the Epson HX-20 and probably the same as those used in dictating machines — and the 22 column thermal printer the rest of the insides are taken up by a four cell Ni-Cad pack and a small PCB. This latter carries both the electronics to drive the printer and microcassette and the charging circuitry for the Ni-Cads. There is one large IC and three other quite ordinary ones which re-inforces the theory that the CPU handles the I/O. However, there are two mysteries remaining. The first is moderately easy to solve in that the only thing the un-documented nine-pin connector at the back could be used for is interfacing the PC-1251 to a larger system although no-one is saying much about that yet. The other intriguing little cover is slightly harder to spot, it is located at the very back of the platform the PC-1251 sits on so you never really notice it. It covers absolutely nothing, it doesn't even give access

Benchmark	Sharp PC-1251	Sharp PC-1211	VIC-20
BM1	42.7	229.6	1.1
BM2	71.6	321.2	8.0
BM3	164.5	583.4	15.2
BM4	169.4	581.7	16.8
BM5	200.3	723.0	18.1
BM6	433.1	* * *. *	25.4
BM7	583.3	* * *. *	41.0
BM8	98.8	192.0	9.8

Table 1. The Benchmark test results. Those on the PC-1211 column marked * * *. * cannot be run as there is no DIM facility in its BASIC.

to anything on the PCB, so its purpose or future potential is really anybody's guess.

The microcassette happily saved all the programs and data files I gave it and the facility to use a second tape recorder also worked fine — the reason for this will become apparent shortly. Sadly the thermal printer didn't really come up to scratch and consistently gave a rather faint output. It is, however, much quieter than the old impact device supplied with the PC-1211. I tried different paper rolls in case the damp had got at them — perennial problem with both thermal and electrostatic printers — but to no avail. The output is still readable, it just could be better.

OF BASIC INCOMPATIBILITIES

Sharp have always been better than most in making sure that the bulk of programs written for one of their machines will operate on any others of the same type, they even managed to make the MZ-80A and the PC-1500 share a common core of both instructions and, interestingly, error messages. So, as the PC-1251 is a replacement for the now outdated PC-1211 it should come as no particular surprise to find that they are, broadly speaking, compatible. A whole section of the manual is given over the detailing the alterations you wil need to make to get listings from a PC-1211 directly into the new machine. This is the reason that they provide a single audio input jack on the module — you cannot save programs externally, only load them. It is also interesting to note that if you used a microcassette it wouldn't work! This is because the internal system is digitally encoded and not based on the normal audio tones.

In general the BASIC is identical to that available on the PC-1500 with the exception of the graphics commands used by the pen plotter. Nowhere does it state that programs from a PC-1500 can be loaded into the PC-1251 although a comparison chart is given in the manual. My PC-1500 was not available at the time I had the review machine so I was unable to try it out, perhaps someone out there knows?

Overall the language is unremarkable, it has everything a good Microsoft-type BASIC should within the constraints of a machine with limited variable space. I won't go into the problems of coping with a basic 26 variables again as this has been more than adequately covered in previous reviews of pocket and hand-held machines. Suffice it to say that if you are careful in your approach it is no problem, after all you will only be writing programs of around 3K!

SO, WHAT'S IT LIKE?

I was desperately trying to find a machine to directly compare against the PC-1251 which wasn't a hand-held and then one of my colleagues happened to walk in and ask where the VIC-20 had been hidden. There, in one chance remark, was the answer. Put at the most fundamental level the PC-1251 has the same operational parameters as the VIC-20; they both have about 3K of usable memory, a BASIC interpreter, the capability to drive a dedicated printer and they both have very restricted display facilities. As for processing speed, well Table 1 tells the story here and the reasons should be fairly obvious in that CMOS processors tend to run slower than the more usual NMOS devices. The PC-1251 is quicker than its older brother for the simple reason that it uses an eight-bit processor rather than a four-bit one.

In use my only criticisms are that the main slider switch is awkward and fiddly and that the keys are about as small as it is humanly possible to get. However, no-one makes any claims that the keyboard will be used for touch typing contests. (Sharp thoughtfully provide a typing tutor program as one of the examples on the demo tape to allow new users to gain keyboard familiarity.) Sharp's manuals are better than many but still suffer from inept translation at times. All the information is there, although not really in the form that a beginner could cope with. Mind you, the sort of person who buys one of these is likely to have the motivation to make that problem disappear as I suspect that, once again, the main market will be people who might have considered a programmable calculator rather than a personal computer.

IN THE END

Despite my very best efforts to render the system into its various component parts and then reassemble them the PC-1251 operated flawlessly. Only time will tell if it stands up as well as the ever faithful PC-1211, I see no reason why it shouldn't. The addition of a cassette mechanism to the printer module for program storage and the inherent compatability between the various Sharp machines make their latest offering more interesting than the Casio alternatives — although the latter have gone some way towards improving their calculator image by changing to a QWERTY style keyboard.

By no stretch of the imagination would anyone claim it to be in the same league as the Hewlett-Packard machine but for a potential programmable calculator user it offers a very attractive package indeed. Besides, you'll learn more about good programming with one of these than you will with almost anything else. You can do an awful lot with 3K, if you try hard enough and obey the basic rules.

FACTSHEET	Sharp PC-1251
CPU	CMOS 8-bit
ROM	24K
RAM	4K (3K user RAM) Battery back up
Language	BASIC
Keyboard	52 keys, full alpha-numeric, Square QWERTY layout, Numeric keypad, Cursor control keys, 18 user definable function keys
Display	24 characters on LCD strip, Virtual line of 80 characters
Cassette	Microcassette in optional module
I/O	Module port
Options	CE-125 microcassette and printer module
Cost	PC-1251: £79.95, With options: £99.95
Supplier	Sharp Electronics UK, Thorp Road, Newton Heath, Manchester M10 9BE, 061-205 2333

BACKNUMBERS

NOVEMBER 1981
Adler's Alphatronic examined, Teletext explained, Speech synthesis board reviewed, Beginners' guide to BASIC.

DECEMBER 1981
DIY DOS for NASCOM, Is Viewdata taking IT's place in society, Digital 'scope simulator for the classroom, Making music with a Genie or TRS-80, The Sorcerer reviewed, Computers in schools.

JANUARY 1982
SuperBrain revisited, PC-1211 programming, FORTH language tutorial, Tandy and Sinclair printers reviewed.

FEBRUARY 1982
The Computer Programme investigated, Graphics for Apple, Sorcerer and Tandy, User programmable characters for ATOM.

MARCH 1982
User report on the BBC Micro, DIY computerised security system, Terminology translated, Classroom computers reviewed.

APRIL 1982
The Valley program, TI-99/4A and Tandy Color Computer reviewed, Report on Centronics 737/739 printers, Basic hardware series.

MAY 1982
Reflections graphics series, Microsoft SoftCard reviewed, Personal computers against mainframes, After the Computer Programme.

JUNE 1982
Two-pass assembler program, Osborne 1 reviewed, Program protection ideas, FORTH simulator in BASIC.

JULY 1982
Advanced BBC programming, Sharp PC-1500 reviewed, Tandy's BASIC displayed, NASCOM toolkit utility package.

AUGUST 1982
Elegant programming techniques, Sinclair's Spectrum analysed, Data storage techniques, 3-D Apple graphics.

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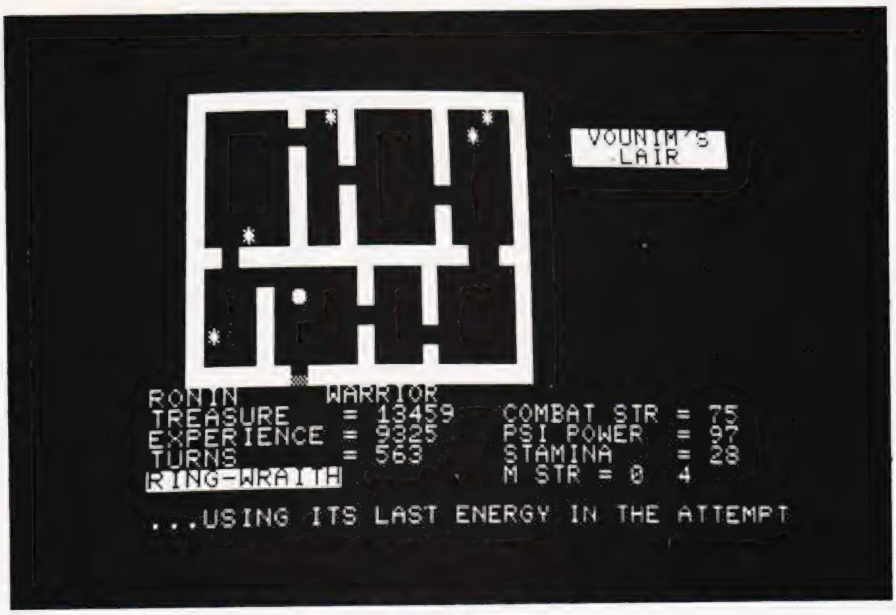
VALLEY VARIATIONS

A selection of the best of our readers suggestions for extending the scope of our Valley adventure.



Over the past year we have received many letters, telephone calls and even enjoyed long and interesting discussions with readers who have implemented The Valley game on their computers. (For those of you wondering what the fuss is about, The Valley was a multi-system 16K graphic adventure game we published in April last year.) The upshot of all these conversations has been that, as interest in the game is so intense, we decided to collect together all the best suggestions that our gallant adventurers had made and publish them for the rest of you to incorporate into your own versions.

The programming conventions employed by the original version apply here, CT standards are used for any graphics etc, and with the exception of the BBC machine all the line numbering will correspond too. Hopefully this will inspire other Valley adventurers to submit their suggestions for extra spells, scenarios etc.

For those of you coming across the game for the first time and wishing to obtain a copy of the original article for reference we have reprinted the 16 pages of listing and explanation and this is available from our 145 Charing Cross Road address for £1.95 inclusive. Please mark your orders 'Valley Reprint' and make cheques etc payable to ASP Ltd. Versions of the game for most of the popular micros are available on tape and disc, see the order form on page xx.

SPELLING IT OUT

Brian Dick

I have recently programmed The Valley into my TRS-80 Model 1. I was interested to learn that other readers have used CHR$ (149) for the lake instead of CHR$ (191). Originally I too opted for the former, but I feel that the latter gives a better graphical representation of the lake.

For those who wish to change their lakes back to 191s the modification is:

1) Change all 149s to 191s in lines 2170, 3030, 9000, 12080-12140
2) Insert line 2121:

```
2121  IF S=2 OR S=3 THEN VV=91 ELSE
      VV=191
```

3) Change line 2130 to:

```
2130  IF Q1=VV OR Q1=91 THEN TN=TN-1:
      GOTO 2030
```

If desired the graphics symbols representing the swamps, woods and the Tower in the Valley scenario can be changed. The swamps can be represented by cursors, the woods by up arrows and the Tower by a plus sign. They are still, I'm afraid, a little crude compared to the PET version, but Tandy owners should be pleased with this minor improvement.

```
2110  Q=79:Q1=PEEK(W):IF Q1=32 THEN 2190

2111  IF S=1 THEN IF Q1=43 OR Q1=45
      OR Q1=91 THEN 9000
2112  IF Q1=86 OR Q1=89 THEN 9000
```

1) Change line 2110 to:

```
2110 Q=79:Q1=PEEK(W):IF Q1=32 THEN 2190
```

2) Insert the following lines:

```
2111 IF S=1 THEN IF Q1=43 OR Q1=45 OR Q1= 91
     THEN 9000
2112 IF Q1=86 OR Q1=89 THEN 9000
```

3) Delete line 2140.
4) Change all 87's to 91's and all 84's to 43's and all 83's to 45's in lines 9170-9200, 10280-10300.

I have added three new spells in my version of The Valley. The keys used for some of the original spells have been changed and the new arrangement is:

1) Sleep Spell	2) Magic Missile
3) Psi-Lance	4) Spell of Invisibility
5) Dispel Evil	6) Crispit

These spells, together with another idea which I have incorporated in my version, are explained in the following episode in the story . . .

THE VALLEY

"I, Alarian the Wizard, fear that too few of those who enter The Valley ever return . . . Vounim is becoming too powerful. As he increases in power, I gradually become weaker . . .

"It is because of this that I have called on my half-brother, Dantor, to help us in our continuing quest for the recovery of the Helm of Evanna. With his help I can teach you three new spells. If you use them wisely you should survive the perils which lurk in The Valley.

"The first of these spells enables you to use magic missiles. If you are experienced in using them they can be deadly, but to the novice they are of little use in combat.

"The second is the spell of invisibility, which enables you to deceive the eyes of most monsters and thus escape unharmed if, when weak, you encounter an evil Dragon or the like! After using a Psi-Lance, this spell will seldom fail.

"The third spell enables the user to dispel the evils of Vounim! Unfortunately the forces of evil in the forests and swamps are too great to dispel . . .

"As you may know, Dantor is the only wizard who holds the secret of the magical lightning which, on striking a living being, can act as a magical aura and will restore power when one is weak. However, Dantor has always had a lust for gold and precious stones. Only if he is rewarded with treasure to the value of 1000 gold pieces will he help you. Do not call on him unless you have enough treasure! You will be in enough danger in The Valley without having to deal with Dantor's wrath! Now go into The Valley and may you return with the Helm of Evanna!"

THE NEW SPELLS

In the following routines, I have used PRINT D$ and PRINT SP$. Tandy users should be able to change this to make it compatible with their versions of The Valley. PET users should bear in mind that RND(0) is the Tandy equivalent of RND(TI) and that, on the Tandy, semi-colons follow all messages to prevent Line Feeds. Some guidelines to aid in the graphics conversions for other computers are given below:

Code	Represents
143	symbol (a small block on the Tandy) representing the blinding light when evil is being dispelled and Dantor's magical lightning
48	symbol (a 0 on the Tandy) representing both your character and Dantor.

```
4520  IF VAL(GC$)>0 AND VAL(GC$)=<6 THEN 4540
4550  ON VAL(GC$) GOSUB 5000,5590,5200,5690,
      5740,5400
5590  C=C-7:IF C<=0 THEN SC=5:RETURN
5600  PRINT D$;"MAY MY MAGIC DEFEAT THEE!";:
      DF=120:GOSUB 36000
5605  IF MS=0 THEN PRINT D$;"ALAS! THE MISSILE
      WILL NOT HELP YOU HERE!";:DF=90:GOSUB
      36000:SC=2:RETURN
5610  PRINT D$;"A MAGICAL MISSILE SPEEDS
      TOWARDS THE MONSTER!";:DF=140:DL$="W":
      GOSUB 36000
5620  IF RND(0)>0.7 THEN PRINT D$;"IT MISSED!";
      :SC=2:RETURN
5630  D=INT(RT*(PS/10)-((MS+N)/20)+RND(5))
5640  PRINT D$;"THE MISSILE HITS THE ";:IF D<=0
      THEN D=0:PRINT "CREATURE BUT CAUSES NO
      DAMAGE.";:ELSE PRINT "CREATURE
      CAUSING";D;"DAMAGE...";
5660  MS=MS-D:IF MS<=0 THEN MS=0:GOTO 5680
5670  SC=2:RETURN
5680  DF=97:GOSUB 36000:PRINT D$;"THE BEAST
      LIES DEAD AT YOUR FEET.";:EX=EX+U:CP=0:
      SC=1:RETURN
36145 RT=INT(0.067*(EX+TS/3)^0.5+LOG(EX/
      ((TN+1)^1.5))):IF RT>28 THEN RT=28
45010 DELETE THIS LINE
```

The Magic Missile spell.

```
5690  IF EX<3000 OR PS<60 THEN SC=4:RETURN
5700  C=C-11:IF C<=0 THEN SC=5:RETURN
5710  PRINT D$;"MAY YOUR EYES DECEIVE YOU AND
      MAY I ESCAPE UNHARMED!";
5711  IF RND(0)>0.4 AND N>15 THEN DF=175:
      GOSUB 36000:SC=6:RETURN
5720  SS=PEEK(M):RR=Q1:GOSUB 60119:DF=155:
      GOSUB 36000
5730  PRINT D$;"THE CREATURE LEAVES, PUZZLED.";
      :DF=50:CF=0:GOSUB 36000:RR=SS:SS=Q1:GOSUB
      60119:SC=1:  RETURN
60119 AA=9:TT=450:REM ** SPECIAL EFFECTS ROUTINE
60120 FOR TT=0 TO TT-20
60121 POKE MM,SS:NEXT TT:FOR TT=0 TO TT-20:
      POKE M,RR:NEXT TT:AA=AA-1
60122 IF AA<>0 THEN 60120
60123 RETURN
```

Make yourself invisible.

```
5740  IF EX<4000 THEN SC=4:RETURN
5745  IF S=2 OR S=3 THEN PRINT D$;"THE FORCES
      OF EVIL ARE TOO STRONG HERE.";:SC=2:
      RETURN
5750  C=C-18:IF C<=0 THEN SC=5:RETURN
5760  PRINT D$;"WITH THE POWER OF MY MIND MAY
      I DISPEL THIS EVIL...";:DF=140:
      GOSUB 36000
5770  IF RND(0)<0.3 THEN SC=6:RETURN
5780  PRINT D$;"A BLINDING LIGHT CONSUMES THE
      MONSTER AND THEN SLOWLY FADES AWAY...";:
      SS=PEEK(M):RR=143:GOSUB 60119:RR=SS:
      SS=143:GOSUB 60119
5790  CF=0:SC=1:RETURN
```

How to Dispell Evil.

SUMMONING AID

To call on Dantor, the player must type 'C' in response to the question, 'Which way?'

```
 2061  IF GC$="C" THEN GOTO 60124
60124  PRINT SP$;D$;:PRINT D$;"DANTOR
       MATERIALISES...";:CC=PEEK(M):SS=CC:
       RR=48:GOSUB 60119:DF=30:DL$="W":
       GOSUB 36000
60125  IF TS<>0 THEN 60129 ELSE PRINT D$;"THOU
       HAST NO TREASURE! DANTOR IS ANGRY!";:
       DF=95:DL$="W":GOSUB 36000:
       IF C>10 THEN C=C-20
60126  IF CS>10 THEN CS=CS-10 ELSE CS=1
60127  IF PS>10 THEN PS=PS-10 ELSE PS=1
60128  GOTO 60134
60129  IF TS<1000 THEN TS=0:PRINT D$;"NOT ENOUGH
       TREASURE FOR DANTOR HAST THOU!";:DF=90:
       GOSUB 36000:  PRINT D$;"HE STEALS ALL
       YOUR TREASURE!";:DF=80:GOSUB 36000:
       GOTO 60134
60130  IF CS<30 THEN CS=30
60131  IF PS<30 THEN PS=30
60132  C=200
60133  TS=TS-1000:PRINT D$;"A FLASH OF LIGHTNING
       STRIKES YOUR BODY!";:SS=48:RR=143:GOSUB
       60119:SS=RR:RR=48:GOSUB 60119:DF=20:GOSUB
       36000
60134  SS=48:RR=CC:PRINT D$;"DANTOR
       DEMATERIALISES!";:GOSUB 60119:DF=20:GOSUB
       36000:GOTO 2010
```

RINGING THE CHANGES

Dave Williams

Being both an adventurer in The Valley and a fan of Tolkein's **Lord of the Rings**, it seemed to me unfair that Frodo Baggins could put on his ring and become invisible whereas I was left to the tender mercies of a random number generator to avoid monsters.

I have, therefore, added a few lines to the program to give an extra find — a ring of power — which can be found after the Amulet but before the Helm and gives the player the option to attack or retreat from any monster with a psi power of less than 25; or any other number for those braver or more cowardly than I. In my version, the ring T(3) can be found in the Temple of Y'Nagioth, but BEWARE . . . it slips off your finger if your stamina falls below 20!

I hope this may help the 'dolts' of Valley adventuring achieve successful completion of the game.

```
  100  DIM D(3),G(73),P(8),N(8),S(4),T(3)
 1185  INPUT#1,T(3)
 2820  IF S=6 AND RN>0.95 AND T(1)=6 AND T(2)=0
       AND T(3)=1 AND RT>25 THEN T(2)=1:
       GOTO 2870
 2835  IF S=5 AND RN>0.7 AND T(0)=1 THEN T(3)=1:
       GOTO 2885
 2885  PRINT D$;"[REV]YOU FIND THE RING OF POWER
       [OFF]":GOTO 2930
 2930  TS=TS+100*(T(0)+T(1)+T(2)+T(3)+FL)
 3489  REM ** CHARACTER'S COMBAT ROUTINE
 3490  IF T(3)=1 AND N<25 THEN PRINT D$;"[REV]
       THE RING HIDES YOU[OFF]":DF=40:DL$="D":
       GOSUB 36000:GOTO 3510
 3655  IF C<20 AND T(3)=1 THEN PRINT D$;"[REV]
       THE RING SLIPS OFF[OFF]":T(3)=0
50165  PRINT#1,T(3)
55070  T(0)=0:T(1)=0:T(3)=0:TS=0:CS=30:C=150:
       PS=30
```

BBC CONVERSIONS

M Stanger

I recently converted your Valley game to run on my BBC Microcomputer, an expanded Model A. Some of the changes made to your original listing are given here as they may be of interest to other BBC Micro users.

At first sight it might appear that one of the graphics modes would be best suited to this application, and indeed the original conversion was begun in Mode 5. However, though excellent graphics are available in this mode, the large size text proved difficult to use and, due to the amount of information to be displayed at any one time, this mode had to be abandoned. Modes 0 to 3 use large amounts of RAM to produce their high resolution graphics and consequently insufficient space is left for the rest of the program.

The final choice was, therefore, Mode 7, and this also had the advantage of sufficient memory to allow future expansion of the program. The graphics are constructed from the Teletext graphics blocks which can be POKEd directly to the screen in the following way.

The top left hand corner screen location is HIMEM. To move right or left, add or subtract 1, thus (HIMEM+ 1) is the location one position to the right of HIMEM.

To move vertically 40 must be added or subtracted for each line moved. The Valley scenario was drawn as follows.

```
10810  FOR X=HIMEM TO HIMEM+521 STEP 40:?X=146:
       NEXT X
10820  FOR X=HIMEM+1 TO HIMEM+521 STEP 40:
       ?X=255:NEXT X
10830  FOR X=HIMEM+39 TO HIMEM+579 STEP 40:
       ?X=255:NEXT X
10840  FOR X=HIMEM+1 TO HIMEM+39:?X=255:
       ?(X+520)=255:NEXT X
```

(The line numbers correspond to the published listing.)

This POKEs the graphics codes directly to the screen and prints the Valley border.

A routine was then developed to draw the random paths again POKEing graphic characters to the screen.

Other symbols can be POKEd directly using their ASCII code. For example:

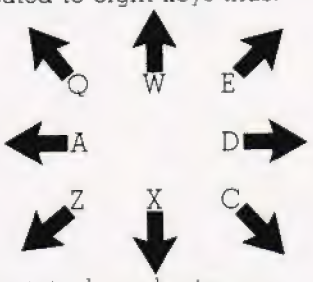
```
10300  ?(S(4))=ASC"T"
```

or:

```
10306  ?(S(4))=84
```

Extensive use was made of PEEKing both printed and POKEd characters to determine the location of the player or 'finds'.

The movement routine was allocated to eight keys thus:



The original numbering was followed as far as possible but since the upper limit for line numbers on the BBC Micro is 32767 renumbering was necessary.

STORING IT

The tape handling routine was rewritten to suit the machine as follows:

```
1090  X=OPENIN (J$)
1100  INPUT#X,PS....ETC
1210  CLOSE#X
```

also:

```
50070  X=OPENOUT (J$)
50080  PRINT#X,PS....ETC
50190  CLOSE#X
```

The Anykey, Uniget and Combatget routines were rewritten to take advantage of the INKEY function. This allows the use of:

```
GC$=INKEY$(Time)
```

where Time is the time, in centiseconds, that the computer will wait for an input before proceeding. The following shows a practical example:

```
1700  *FX 15,0:REM ** EMPTIES BUFFER
1710  TV=1:GC$=""
1721  GC$=INKEY$(100)
1730  IF GC$<>"" THEN TV=0
1740  PRINT D$,SP$:REM ** WIPE MESSAGE
1750  RETURN
```

This avoids jumping out of a FOR . . . NEXT loop when a key is pressed.

It was found necessary to alter line 36090 to allow the maximum psi strengths of the character types to agree with Table 2 (p.55). The new line reads:

```
36090  IF PS>INT(42*(P1+1)^LOG(P1^8.518))+75
       THEN PS=INT(42*(P1+1)^LOG(P1^8.518))+75
```

The game has proved very popular with my family all of whom have suggested improvements.

The major change was to incorporate a choice of playing speed to allow the younger members of the family whose reading speed is not so quick to enjoy the game. This choice is contained in an instruction block which is incorporated into the early part of the program.

It is not suggested that my version is the ultimate in programs, but it has resulted in an exciting and popular game. Although conversion may at first sight seem a daunting task, the end result is well worth the effort.

RESEARCHING VALLEY GRAPHICS

Adrian Gothard

Some months ago I converted The Valley to run on an RML system and, as these are popular in many educational establishments I thought that you might like to pass on the following conversion hints to your readers. Apart from the various graphics characters which had to be changed, see Table 1, alterations are generally minor and I have found the game no less enjoyable to play than does a friend who runs it on a PET.

CONVERTING POKES

The routine to convert the PET-type memory mapped screen to the RML's graphics display is slightly more convoluted, however, and bears closer examination. It proved easier in the end to substitute POKE M, GC with PLOT FNX(M), FNY(M), GC whenever a POKE appeared in the original listing. The defined functions are generated as follows:

```
DEF FNX(Z1)=(INT(80*FNG(Z1)-INT(FNG(Z1))))
DEF FNY(Z1)=(INT(59-3*INT(FNG(Z1))))
DEF FNG(Z1)=(Z1-32768)/40
```

Some of your readers may find, as I did, that this works only intermittently because, I believe, of a bug in BASIC V 5.0 A. In this case I used a subroutine and substituted POKE M,GC with Z/=M:GOSUB xxxx:PLOT X,Y,GC. The subroutine is as follows:

```
XXXX  Z1=(Z1-32768)/40
      X=(INT(80*Z1-INT(Z1)))
      Y=(INT(59-3*INT(Z1)))
      RETURN
```

SPECTRUM'S MONSTER DISPLAY

Kevin Hyman

For those of us fortunate enough to have both a ZX Spectrum and the ASP Software tape of the Valley here are a couple of modifications. The first is to allow verification that a character has been saved on tape and is added in lines 9271-6:

```
9271  PRINT "DO YOU WISH TO VERIFY THIS?":
      LET V$="YN":GO SUB 1500
9272  IF I=2 THEN GO TO 9260
9273  PRINT "REWIND THE TAPE, CHECK THE LEADS
      AND THEN PRESS ANY KEY.[9 SPC]IF
      VERIFICATION FAILS ENTER [5 SPC]'GO
      TO 9200' AND TRY AGAIN."
9274  PAUSE 0
9275  PRINT FLASH 1;"START THE TAPE"
9276  VERIFY J$  DATA Z()
```

The second employs the three unused definable graphics characters to display the attacking monster on the square our hero was about to move onto. When it dies he moves forward, but if the retreat option was taken then he stays still and the monster is removed. Three types of monster are available, chosen to represent those with no legs — wights-, one or two pairs of legs — ogres and dragons ***et al.*** These are stored in lines 9950-70 and POKEd into graphics Q, R and S by changing line 210. Line 120 keeps the appropriate shape for each monster, the string has nineteen characters, graphics shifted SRRRR RRQSRSSQSSQRRS. Lines 2190-2200 prevent movement occurring if battle is about to commence, line 3185 displays the monster and lines 3875-3879 replace it with the good guy. Lines 3905-6 handle any momentary cowardice during a retreat, lines 4260 and 4570 ensure the removal of a spelled or exhausted monster.

Happy hunting, don't fight until you see the whites of their eyes.

```
9950  DATA 0,16,55,124,84,124,124,254:
      REM ** GHOST
9960  DATA 28,28,62,127,93,93,85,20:
      REM ** FIENDS
9970  DATA 0,0,111,236,62,62,34,34:
      REM ** BEASTS


 210  FOR J=144 TO 162


 120  DIM N$(19):LET N$="SEE TEXT FOR GRAPHICS
      STRING"


2190  LET Y=W1:LET X=W2:GO SUB 1800:
      REM ** SCREEN$
2196  LET PK=I:LET RF=RND
2197  PRINT AT M1,M2; INK COL; OVER 1;CHR$(Q)
2198  IF PK=144 OR PK=145 OR RF>=0.33 THEN
      LET M1=W1:LET M2=W2
2199  PRINT AT M1,M2; OVER 1;CHR$(Q)
2200  IF PK=144 OR PK=145 THEN LET DF=5:
      GO TO 2250
2220  IF RF<0.33 THEN GO TO 3000:
      REM ** MONSTER SELECT
```

```
3185  LET RF1=RF:PRINT AT W1,W2; OVER 1;N$(RF1)
3905  PRINT AT W1,W2; OVER 1;N$(RF):
      REM ** RUB OUT MONSTER
3906  LET W1=M1:LET W2=M2:REM ** STAY
      WHERE YOU ARE

4260  GO TO 3875:REM ** NOW MONSTER IS DEAD
      MOVE GRAPHIC

4570  GO TO 3875:REM ** NOW MONSTER IS DEAD
      MOVE GRAPHIC
```

Scene	Object	PET	RML 380Z
Valley	Border	214	143, 191, 188 (top, sides, bottom)
	Safe Castle	219	37
	Path 'up'	78	154
	Path 'down'	77	169
	Woods	216	87
	Swamps	173	7
	Tower	87	14
	Character	81	127
Woods	Border	96	192
	Trees	88	94
	Lake	224	255
	Vounim's Lair	230	188
	Character	81	127
Swamps	Border	96	192
	Tufts	45	7
	Lake	224	255
	Y'Nagioth	230	188
	Character	81	127
Tower Vounim & Y'Nagioth	Border	160	188, 143, 191 (top, bottom, sides)
	Walls	160	191
	Stairs	102	153
	Doorway	104	176
	Treasures	42	42
	Character	81	127

Table 1. The suggested character codes for the RML 380Z.

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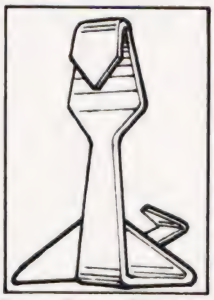

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Henry Budgett

#FILE

In a month where the world's biggest computer company went personal the Editor examines the probable consequences for the rest of us.

It's official, the Personal Computer is no longer a dirty word conjuring up ideas of long-haired young people playing zap-the-alien until two in the morning. Why? Well, when a company the size of IBM decides to finally dunk its feet firmly into the market the rest of the industry really has got to start to take the whole business very seriously indeed! It has been obvious that the time was going to come, the machine has been available in the US since late '81 and a fairly large number of 'grey imports' were already available here but January 18th was the day they finally gave the word.

As a well-kept secret the launch was really a failure, the writing had been on the wall for months, but with their usual reluctance to pre-announce anything IBM even refused to confirm the event some three days previously. When the news broke, at the Which Computer Show, Europe found that not only had it inherited the machine but also the manufacturing as well: all the European PCs will be built at the IBM plant in Greenock. As a blow against the oft-reported jobs crisis caused by computerisation this will hardly scratch the surface of the local dole queues but it does show the seriousness with which IBM regard the European market, it's going to cost them some £8 million to expand the plant.

THE HARD STUFF

The system is aimed directly at the small to medium sized business for stand-alone use or for other professional users, it's certainly not going to be common in the domestic market with a price tag of £2,080 for the most basic system. What you are, in reality, paying the money for is the great deal of experience and back-up that you can call on, something that, for the businessman at least, is worth its weight in fivers. At last he'll be able to walk into his local bank and say he wants to borrow a few thousand to install a small computer. Instead of being faced with a blank expression when he names 'brand X' as the system of his choice it is more than likely that the name of IBM will re-assure the money man that our businessman knows what he's up to. It might sound a little silly to you but, believe me, it happens like that.

In return for the £2,080 (plus the ever present VAT) IBM will give you three boxes and a pile of manuals to read. The main box contains the 16-bit CPU (an 8088), 64K of RAM (expandable to 512K), single 160K disc drive (expandable to two 320K discs), four expansion slots for extra RAM and the like plus all the usual systems software packed into 40K of ROM. The keyboard is detachable with a total of 83 keys including cursor, editing and numeric functions. The display screen sits on top of the main unit and is to the usual standard of 25 lines of 80 characters. Various display options are catered for including reverse characters and highlighting, these tie in with the various software packages. A colour display is also available for those who wish to brighten up their figures!

In addition to the basic bits and pieces IBM are also offering a graphics printer, an Epson by any other name if the pictures are anything to go by, plus a whole bunch of business oriented software. Among the latter are VisiCalc, Multiplan and Easywriter but it is interesting to note that a couple of games seem to have crept in there too including a Microsoft Adventure and, as reported elsewhere in this issue, the Med Systems series. The native language is a 16K interpreted BASIC and the DOS is the Microsoft's MS-DOS which is also to be found on the Sirius/Victor machine.

THE OPPOSITION

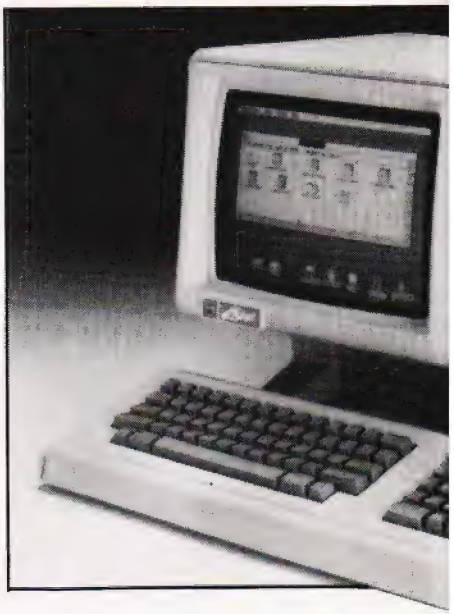
By the end of this year the small business market will look very different indeed to its current state. We already have the Sirius/Victor system making heavy inroads, DEC are coming on strong with their Rainbow and now IBM have joined in too. Our very own ICL gave up trying to produce their own in time and settled for the Rair Black Box but even they are talking quietly about a desktop system, Clive Sinclair's hand has been evident here.

As to who is going to be the winner, or loser, only time will tell but provided they can all deliver the right product at the right price I can't see them having too much trouble. So, if we have these new contenders at the upper end of the scale what happens to those companies we currently associate with this market? Well, to put it bluntly I think that a lot of them are going to be forced to change their whole outlook on life! If they can't compete on equal terms they are going to be left out in the cold, so what can they do. Well, a number of them have already started to produce IBM-like systems based on the same architecture and software on the grounds that if you can't afford an IBM you might buy something that

Top right: IBM's long awaited entry to the personal market, the PC.

Right: Apple's enhanced II. More memory but more money too.

Below: The up-market Lisa machine from Apple.



at least behaves like one. Other companies are adopting the policy that if a serious small business machine now comes at £2,000 and up there must be a market for a serious very small business machine at, say, £1,000 and up. Others are just carrying on as usual in the hope that they will be able to survive on the crumbs and just a few are going for broke on the path to super systems based on the new 32-bit processors. All in all, it is going to be a very interesting year!

THE OTHER NEWS

Coming, as it did, one day after the IBM launch the latest news from Apple may have slipped some people's notice. In its way the launch of ***their*** super system, Lisa, is an indicator of the way in which that company will move over the next year. The original Apple II machine, still successful after all these years, also got a shot in the keyboard with the introduction of the Revision E system. More of that later but first let's take a look at the enigmatic Lisa.

To start with it is not really a hardware plus software machine at all in the sense we are used to, Lisa stands for Local Integrated Software Architecture, as the programs it is supplied with are an integral part of the system. The hard part is based around Motorola's 68000 processor with between 512K and 1M of main memory plus between 1.7M and 11M of disc store. The most interesting thing on the hardware side is the introduction of a 'mouse'. This is a small motion sensing box which is used to control the screen cursor in menu-selection mode which means that for most routine tasks other than data entry the user never needs to touch the keyboard. All the six packages supplied with Lisa use the mouse to control their functions and as they all use the same command structures Apple claim that they are very easy to learn. The facilities offered include word processing, spreadsheet, data base management, graphics and PERT calculation. Information from each can be passed between packages so information from the data base can be processed by the spreadsheet and then added to a report being written with the word processor.

We won't get the machine over here until the Autumn and when it does arrive the price tag is likely to be around £7,500, bear in mind that does include the software. However, as a number of others have pointed out in recent weeks, this is still rather expensive although Apple counter this by stating that you're not just buying the box but the service and back-up too . . . I think we just went through that one!

IN REVISION

I mentioned earlier that some companies would be taking their machines to a new market, ie a business system for £1,000 to cater for the smaller small businessman, and Apple have re-vamped the Apple II for just this market. Now called the IIe it has basically the same shape and characteristics but has been given a new keyboard and uprated to 64K of user RAM. Additionally the changes to the internal architecture mean that you can have two languages resident, Pascal and BASIC say, and swop between them at will. You can have up to 128K of RAM by adding the 80-column card with an extra 64K but the 64K should be adequate for most uses.

There is one aspect of the IIe I must confess I don't like and that is the price. The old II costs £675 whereas the new machine, despite using 25% of the components previously required, runs out at £845. With Commodore claiming their 64 machine to be an Apple-basher I had hoped that Apple would respond by pulling the IIe down to, say, £350. Now, the hardware cost of the II was around $100 last year so even with the poor exchange rate they should have been able to match the prices rather than increase them. Nevertheless, they have made a 'starter kit' option available which comprises a IIe, single drive and controller plus monitor, stand and an un-expanded 80-column card for £1,199 — a saving of some £250 on the individual prices.

Quite whether Apple have started to get cold feet over the current poor showing of the III yet I'm not sure but perhaps this could be one of the first casualties of the IBM launch. Certainly it has not exactly gone like hot cakes in the business market, the slow availability of software cannot have helped. Still, with the IIe granting a new lease of life to one of the industry's favourite systems I dare say that Apple will carry on smiling through '83!

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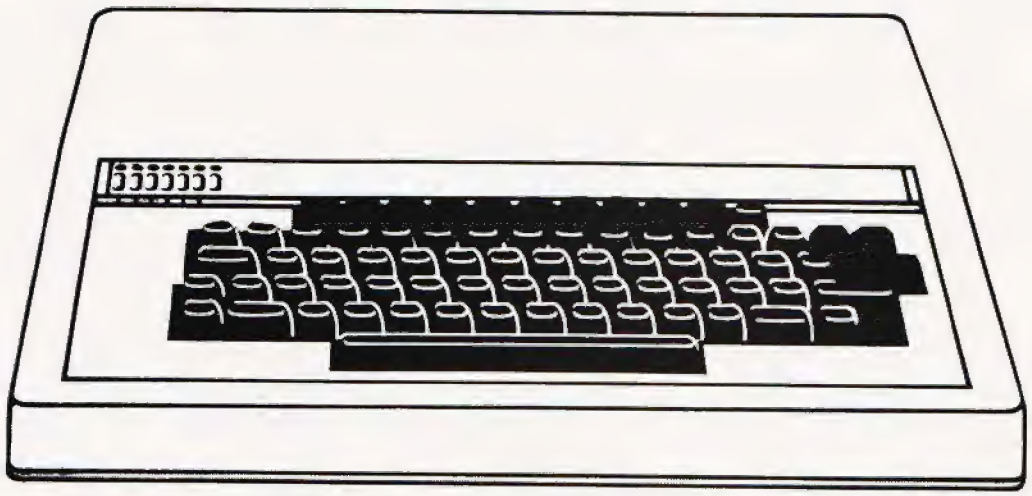

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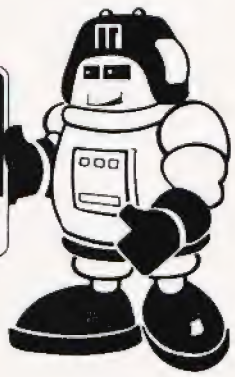


Mike James

GALAXY REVIEWED

One starring feature of this apparently ordinary Z80 based system is that it offers COMAL as one of its base languages instead of the usual BASIC. Apart from this the system offers several other advantages over more conventional CP/M machines as our reviewer has been finding out.

The Galaxy 1 is an interesting machine in that it is a traditional modular computer system but at a price that is far from traditional. The advantages of a fully modular system have always been obvious — easy expansion and repair — but producing systems made up from individual circuit boards has always been more expensive than putting everything on one large board. As a result modular systems have been the province of the 'professional'. The Galaxy is still a professional quality machine and its makers — Gemini Microcomputers — are very keen to promote its business image, a role that it can easily cope with. However because of its low cost and versatility it is worth considering for any serious application that needs a twin-disc Z80 system with 64K of RAM and CP/M. Another reason for being interested in the Galaxy is that it uses a bus that is compatible with the well known 'Nasbus' used by the NASCOM machines. So, if you are a committed NASCOM user then the Galaxy will be of interest to you.

AN OVERVIEW

The Galaxy 1 is attractively packaged in a cream and black steel enclosure measuring 18" by 12" by 7" and weighing 31 lbs. The use of steel is becoming a rarity in these days of low cost plastic computers — even the 2000 series PET which used to be in a tough metal case eventually 'went plastic'. Although plastic is for the most part perfectly adequate the steel case adds a touch of quality and toughness to the Galaxy. From a user's point of view the only interesting features of the case are the two vertically mounted 5¼" disc drives to the right and a small 'on' LED to the left. This gives the machine a clean, easy-to-use look. Round the back, however, things are a little more cluttered. The mains power socket, on/off switch and reset button are all rear-mounted. A group of miscellaneous connectors are mounted to one side. However they are all of very good quality, no corners cut here and each one is clearly labelled. The only two connectors that you have to know anything about to get the machine running are the video output and the keyboard connector. Once the appropriate cables are in place, and there is no fear of confusion, the Galaxy is ready to use. The keyboard is also encased in a metal and separate, detachable unit. It is very good quality and includes all the keys that you need but few luxuries. For example there is a Shift, Shift lock, Control and a set of four nicely laid out cursor control keys but no separate numeric keypad. However the keyboard is once again good quality and simple enough to make you wonder how other manufacturers can get it so wrong.

Once you have the machine switched on then the only thing you have left to do is to get the operating system — CP/M — running. This is easy enough as long as you aren't too familiar with traditional disc drives! The Galaxy uses the very excellent Micropolis drives and these have a two-stage disc loading procedure. First you have to push the disc straight in until it clicks and then you have to 'load' it by pulling the large metal door tab over to the right. This is simple enough once you know but I have seen experienced microcomputer users curse because the drives keep on giving errors when all they needed to do was pull the metal tab to the right to load the disc! Once you have used Micropolis drives for a while you will wonder why anyone should use anything else. Micropolis drives are built to a very high standard with nearly all the working parts in steel. As a result they are very reliable. Another good feature is that a motor-off circuit is included to reduce noise and wear when the discs are not used for a few seconds.

Although the Galaxy is a modular system and modular systems traditionally demand the use of a VDU, it actually contains a video controller board that only requires the connection of a monitor to produce a professional 25 line by 80 column display. This is very adequate for the job in hand and even if

The basic Galaxy system. An upgraded keyboard is now available which is better for business applications.

the Galaxy's graphics are limited to 75 by 160 pixels.

Other features of the Galaxy include a fan and dust filter, provision for using a cassette, a light pen connector, both a serial and a parallel port. The rest of the story of using the Galaxy is very much the story of its software. As it is a CP/M machine it tends to look a lot like every other CP/M machine but it does have a few surprises in store but these are best left to the section on software.

THE HARDWARE

As already mentioned the most important thing about the Galaxy is that it is modular — that is it is made up of a collection of separate printed circuit boards connected together by a 'mother board'. Each of the boards used to make up the Galaxy is available separately as members of a large family of 'Gemini Multiboard' modules. This means that computers other than the Galaxy can use the same electronics! If you wanted to you could build your own computer from the same modules starting small and expanding until you reached the same configuration as the Galaxy and then perhaps even on to an even bigger machine.

Inside the Galaxy's case, things are neatly arranged — to the right are the two disc drives, behind them the power supply and to the left hand side are the card frame and mother board holding the separate modules. The power supply is a standard switched-mode supply made by Astec and this is the main reason why the Galaxy is so much smaller than the older traditional modular computer systems. These tended to use a 'straight' rectifier filter-type power supply that produced unregulated power that was then improved by each separate module — ie each module had an on board regulator (the S100 system for example). This method had the advantage of being reliable and simple but it did require a very large power transformer to supply all the inefficient regulators and, as a result, there was always a lot of heat to get rid of. The Galaxy neatly avoids these problems by distributing regulated power to each of the boards and using a small switched-mode supply. The results is a much smaller and lighter machine.

The card frame to the left of the power supply holds four PCBs and has room for one more. The PCBs are mounted so that removal is from the side and, as there are no card extractors fitted, removal is not easy. The four modules are the CPU card, 64K RAM card, intelligent video card and floppy disc controller.

The CPU card has a great deal of flexibility built into it — perhaps much more than the average Galaxy user will ever know about. The Z80 processor can run at single- or double-speed (double is standard on the Galaxy). It can take on-board ROM/EPROM/RAM in the form of 'byte wide' memory. On the Galaxy only one of the four sockets is used for a 2716 EPROM containing a monitor. There are two other major components on the board — a Z80 P10 providing two parallel ports and a full serial port including modem control lines. The Galaxy uses the parallel ports to provide a Centronics printer interface. The serial port serves two functions — as a serial communications interface and as a cassette interface.

The 64K RAM card is fairly conventional and uses the well known 4116 dynamic RAM chip. A total of 32 4116 chips are used in four rows of eight to provide the full 64K. The layout is good and there are sufficient decoupling capacitors to en-

For serious users the Galaxy offers a solidly built, British alternative to the American offerings.

sure reliable running. There is also a page mode option that allows up to four memory boards to be used at the same time. This option is fitted on the Galaxy but as there is only one empty slot in the card frame it is difficult to see how very much use could be made of it.

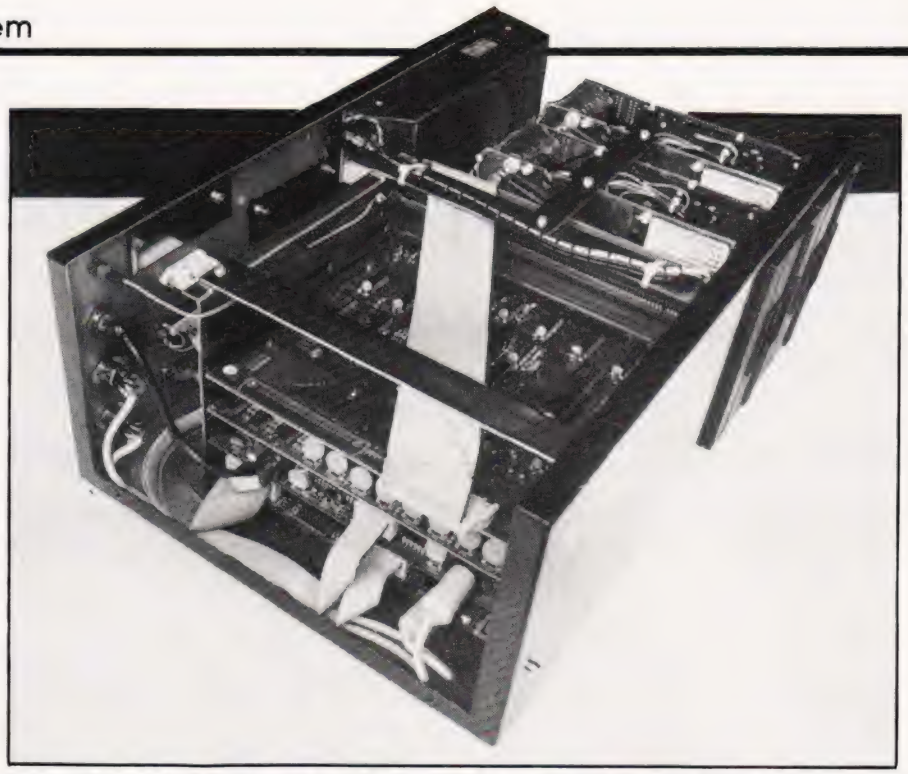
The intelligent video card is perhaps the most interesting of all the modules from the design point of view. It uses a Z80 and a 6845 CRT controller with extra ROM and RAM to make a separate video processor. It is this that makes it possible for Gemini to claim that the Galaxy has two Z80 processors. While this is absolutely true the Z80 processor inside the video board will not be something that the average Galaxy user will be able to appreciate — ie it won't increase the overall speed of his programs. However if you like experimenting, small programs can be down loaded into the board's spare RAM and can be run at the same time as the main program — but this is for experts only!! The video board isn't memory mapped. Instead the CPU card communicates via three I/O ports. All data and commands are sent to the video board via these ports and this might cause something of a bottle neck if it wasn't for the presence of a 128 character buffer in the video board. There are 51 separate control codes that can be used by the main system to move the cursor, scroll areas of the screen and use a medium resolution block graphics facility. In addition to handling the video side of the user interaction, the video board also contains electronics to interface to the keyboard. Although the CPU card also contains a keyboard port the video card is the better option because it contains a type-ahead buffer.

MORE STORE

The disc controller card is used in conjunction with Micropolis drives to provide a quad-density disc system. It is unusual to find the Micropolis drives used with a controller other than one also made by Micropolis. However, the disc controller in the Galaxy is definitely not made by Micropolis and indeed it can be used to control a wide range of 5¼" and 8" drives. The board utilises the 1979 controller chip and uses five I/O ports for communicating with the CPU card. Not only can it handle both sizes of disc it can also handle both double- and single-density. The Galaxy uses only the double-density option.

All the boards are well made with wide tracks and good spacing. In no case do Gemini succumb to the temptation to cram too much onto any board. As mentioned in the introduction to this review, the individual boards all use the 80-Bus which is compatible with the familiar Nasbus (used by the NASCOM range of computers). This means that the spare slot in the card frame can be used not only with the Gemini Multiboard range but with other manufacturers' products intended for the 80-Bus or Nasbus. However, be warned, Gemini do not support any other products than their own so if you use anything strange you must be prepared to 'go it alone'. For a brief selection of extra modules see the section on Expansion.

The final area of hardware interest is the pair of Micropolis disc drives. Used with the double-density disc controller each drive can store 400K. This implies that the overall storage is quad-density. In most cases quad-density is achieved by using double-sided discs but the Micropolis drives are single-sided. The quad-density is achieved by using double tracking at 96 tracks to the inch. This works well but it is a little sad that 100 tracks to the inch wasn't the standard because this would allow disc interchange between the Galaxy and other double-density systems by using 'double stepping' (that is only using every other track). As it is the soft-sectored, double-density, single-sided, 96 tracks to the inch Micropolis drives are about as non-standard as you can find! There seems to be no reason why the Galaxy shouldn't be used with external and perhaps more standard disc drives if the need was really pressing but with 400K per drive there is plenty of storage.



Internal construction is neat and the whole is very ruggedly put together.

SOFTWARE

The Galaxy is a CP/M machine and this brings with it all the usual problems and criticisms. However Gemini have done a lot to make CP/M bearable. Firstly the system auto-boots, that is it reads CP/M in from a system disc as soon after switch-on as a system disc is placed in drive A. Disc error handling has been improved by the simple expedient of keeping errors well away from CP/M! In other words disc errors are intercepted by the BIOS before the BDOS can offer the user its familiar message — 'BDOS ERROR ON DRIVE?' This improves the situation by offering the user better information as to what caused the error and also the option of retrying the I/O operation that caused the error, passing the error on to BDOS or aborting the whole operation with a warm start. Another area that marks a distinct improvement to CP/M is the ability to use screen editing (via the cursor control keys) within CP/M and most programs that run under CP/M. Each of these improvements is easy enough to implement in software, (ie they do not depend on the Galaxy's hardware) so it makes you wonder why other manufacturers haven't bothered?!

Other notable pieces of software that accompany the Galaxy include GEM-PEN - a useful text editor/formatter, GEM-DEBUG - a Z80 debugger and GEM-ZAP - an assembler/editor for the Z80. However, the piece of software that must take pride of place and generate most interest is COMAL. Although it is not difficult to buy several versions of BASIC, FOR-

Adequate interfacing socketry and the provision of a fan reinforce the professional nature of the beast.

TRAN, Pascal, ALGOL etc, that run under CP/M (and hence on the Galaxy) Gemini have shown a great deal of faith in a relatively new language — COMAL. This is a cross between Pascal and BASIC and so should prove satisfactory for nearly everyone — users and educationalists alike! COMAL is a pleasant language to use in that if you want to treat it like BASIC then you can and if you want to improve your programming style then you can bring elements of Pascal into your programs. It sounds as though there cannot be anything to criticise in such a plan. However, when you look at COMAL closely and actually ask what it offers over actual implementations of BASIC, such as Microsoft or BBC BASIC, then you find that COMAL is a little too close to existing BASIC to really merit a new name!! It is true that if you take BASIC as it once was ie single letter variable names, one-dimensional arrays, very limited IF statements, limited control statements etc, then COMAL is a big advance. The only flaw in this argument is that the BASIC most people use has evolved considerably from this primitive language into something more sophisticated and this is very little different from COMAL. Any fuss that is made about COMAL is equally deserved by BASIC dialects such as BBC BASIC, C-BASIC, and many other structured BASICs. If COMAL were to deserve a new name it really should include some features that are new to any dialect of BASIC such as the ability to create data types, the ability to structure existing data types. Features such as records, pointers, sets all have their place in the scheme of things but not in COMAL it seems! COMAL is a good dialect of BASIC but nothing really new.

EXPANSION

By this point in the review it should be obvious that the Galaxy is an expandable machine. There are a wide range of Nasbus and 80-Bus modules that can be used with the Galaxy; the only trouble is that there is only one free slot left in the card frame. This means that unless you want to spoil the overall simplicity of the design of the Galaxy by adding a bus expander then you must choose one of the following — a ROM card, a Digitalker speech synthesis board, a high resolution colour graphics board, an I/O and timer board, an IEEE 488 interface board etc. This lists is by no means exhaustive, it simply contains the modules that I have come across without really trying! You can also get a light pen that will work with the Galaxy's video board but I haven't been able to try it out.

DOCUMENTATION

The documentation that comes with the Galaxy is spartan. That is, it is adequate but there aren't any frills. This seems reasonable in that if you simply want to use the Galaxy then you will be more interested in the documentation that comes with the application software that you are going to use. However, if you are an expert and want to 'play' with the machine then you can obtain circuit diagrams etc that should answer most of your questions. Gemini are quick to point out that if you are in need of further help then there are a number of good introductory books on CP/M, COMAL etc. This is a point of view that I sympathise with. After all, why should a computer manufacturer feel obliged to provide introductory courses on computing; as long as the material exists the user can select whatever he feels in need of.

CONCLUSION

Perhaps I am old fashioned and have a yearning for the good old days when S100 modular computers were all there was, but I find the Galaxy a very attractive machine. Being modular it should be easy to repair, and it is expandable — but the fact that there is only one free slot must be kept in mind. As a professional CP/M machine it is a quality product at a very reasonable price. As an enthusiast's machine it has a clear advantage it you want to build an extra module for it and experiment (prototype cards are available). All-in-all a very well made system for a very reasonable price — if I needed a CP/M disc based system then I would place the Galaxy at the top of my list.

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CPU	Z80
Clock	4 MHz
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RAM	64K
Language	COMAL, Pascal and other CP/M languages also available
Keyboard	Detachable Full QWERTY, 59 keys
Display	80 characters by 25 lines, 160 by 75 pixel graphics
Cassette	1200 baud. CUTS
Disc	Twin Micropolis 5¼" drives, 400K per drive
I/O	Centronics parallel port RS232 serial port
Options	Light pen One spare slot for 80-Bus modules
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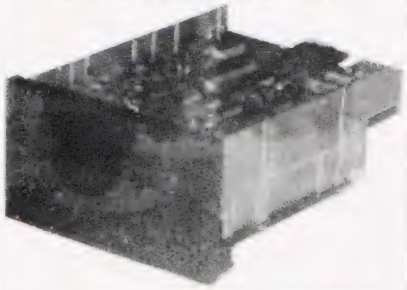

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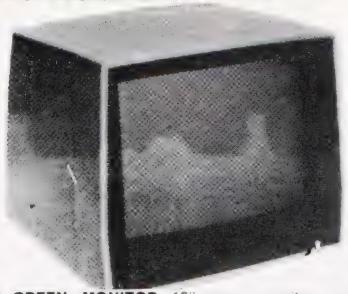

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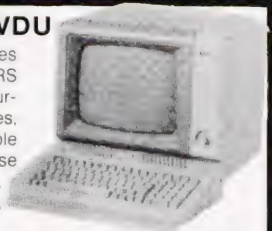

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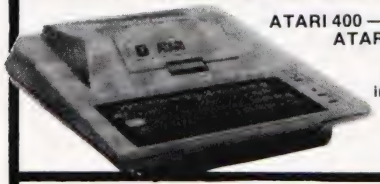

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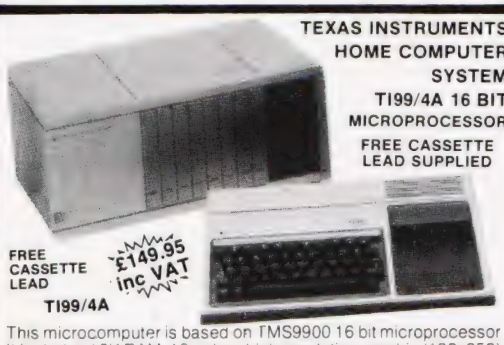

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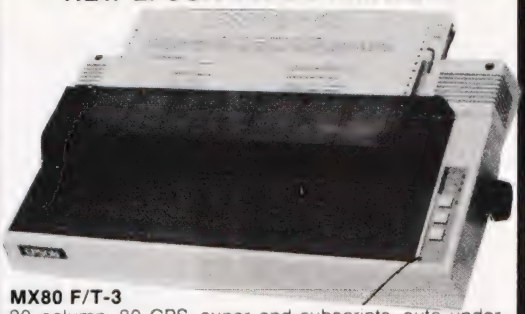

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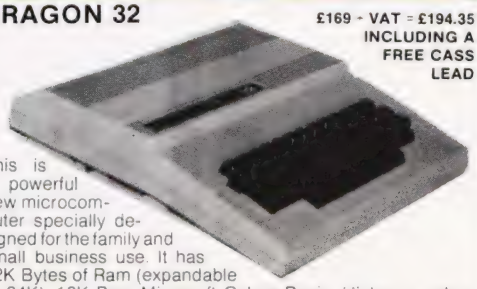

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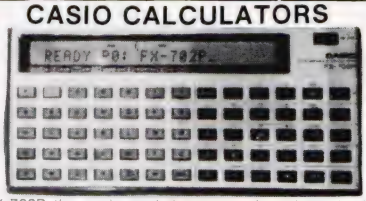

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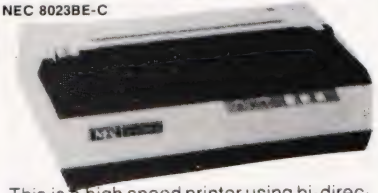

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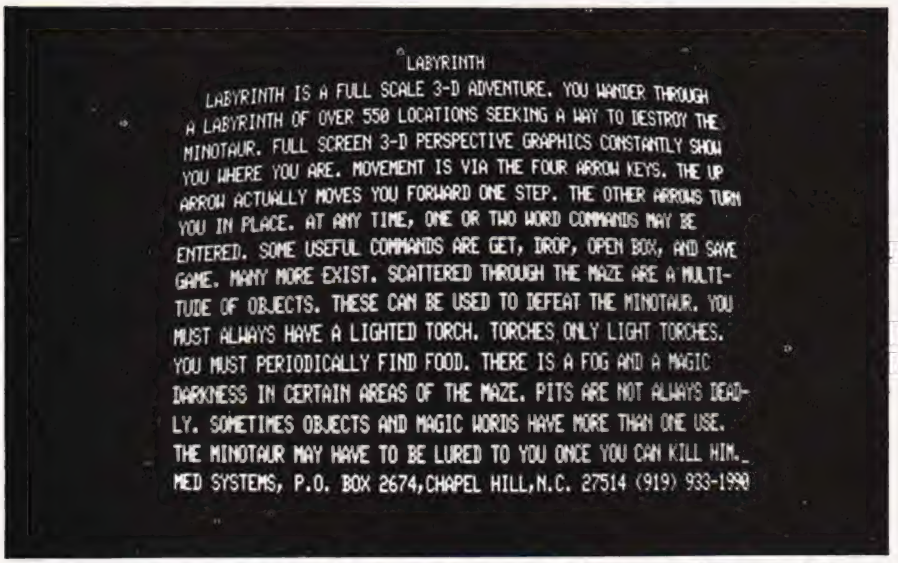


Clear, concise instructions on the screen plus good documentation seem to be the hallmark of the Med Systems adventures.

Med Systems, a company based in North Carolina, have produced a series of adventures which are far more visually orientated.

In Med-Systems 3D adventures, you not only have the features of other adventures, but there are also graphics — long corridors stretch in front of you. If you haven't seen the graphics, you could think of them, as being the view from inside, not from above, a labyrinthine maze. An early version of these games was titled 'Rats Revenge!'. From the main corridors, there are side passages running off in both directions. Pits and elevators are also found, as are doors, which you can see open when you type OPEN DOOR (although you usually can't tell what's behind the door until you walk through it!).

DEATHMAZE

The first of these adventures, DEATHMAZE 5000, was written by Frank Corr, who admits he made it "really hard — I don't want someone to solve in an evening what took me three months to write Deathmaze is undoubtedly the hardest of these adventures, although the graphics are the simplest, and it has a mere 500 locations. The maze is built on five levels. On the first you find a plethora of useless objects — rotten sneakers, a crystal ball and a ring — which come in useful later. The levels are interconnected by pits, elevators, and a Scientific Marvel, which needs to have the right button pressed at the right time.

The first level of the maze can easily be mapped out. The route to the second level is obtruse — somehow you have to CHARGE through a wall — but which? And how do you protect your brains from being splattered?

In these adventures, movements and syntax follow the same rules, and it becomes easy to control your path through the maze once you get the hang of it. There are also graphic representations of beds and desks. Many of the objects are found in boxes. The graphic display showing where you are and any text that you type and the computer's replies are all displayed on the screen simultaneously and clearly.

Although graphic-based, these are true Adventures, and in Deathmaze the major problem is dealing with a monster and a relative of his. The player can type in one- or two-word commands (eg GET JAR, THROW FRISBEE, PLAY FLUTE) and the replies are

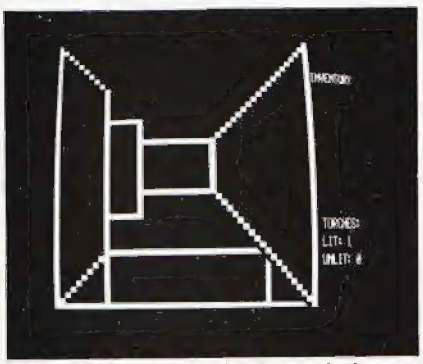
terse and cryptic. HELP gives little information, and as a clue, I'd suggest that rather than INVERT AND TELEPHONE you try and TURN TURN TURN.

There are also the usual features of Adventures, including SAVE GAME which is remarkably fast, even on cassette. Surprisingly, on Deathmaze, the Save Game routine doesn't perform a checksum. This means that you can use any old bit of tape with any old bit of data when you Restore a game, which can leave you in a totally playable situation. In later games, this bug was squashed.

An inventory is constantly displayed, and there is a limit on how much you can carry at any one time. Some items are essential, Food and Light. Food is found in baskets, and is essential to prevent you dying of starvation. Before this happens, your stomach starts to grumble, giving you fair warning that something is amiss.

Being written in American makes the problems difficult for people used to speaking English, and their spelling isn't always 'correct'. There are also differences in our culture and homes: for example, American phones all have letters as well as numbers. But sometimes the problems are too difficult even for Americans, and now Hint Sheets are available. Interestingly, these are given free with the IBM version! The documentation also contains a few useful hints that aren't apparent on first reading.

Corr set out to make Deathmaze the hardest adventure ever written, and in my opinion he succeeded. He was elusively vague when I asked him how many telephone enquiries they received a day from people who were stuck in the maze. The company now have a policy not to give hints over the telephone, partly because the customers seemed to be becoming too abusive. They were nevertheless quite enthusiastic, and a sequel was demanded.

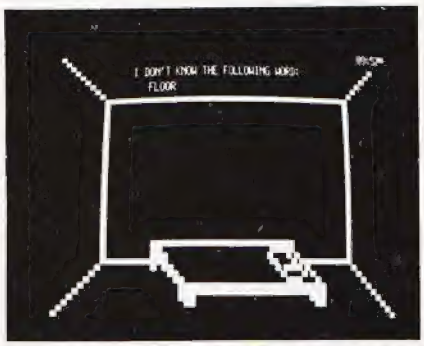


Watch out for pits whilst wandering through the Labyrinth!

LABYRINTH

For the follow-up, Labyrinth, he teamed up with William Denman, a Chemist, who was scared of handling toxic chemicals and who decided instead to write toxic adventures.

The program for Labyrinth was based on Deathmaze, and they made very few alterations to the basic plan, other than changing the layout and text. Labyrinth is much easier than Deathmaze, and would make a sensible 'first buy'. One of Denman's introductions was the 'teleport'. One is suddenly transported from one part of the maze to another, and although this



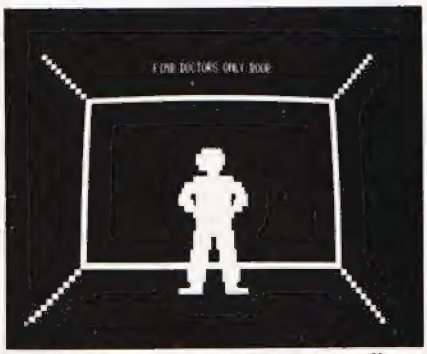
Your time in the Asylum is slowly ticking away and there's no point at all in looking under the bed!

is always consistent, it makes mapping the maze a little confusing at first. Labyrinth features a minotaur and a maiden, a magic darkness and a thick fog, and an ugly man who bites your legs off. Your object is to destroy the minotaur, but needless to say, you won't find the weapon you need until you have explored the maze in its entirety.

It is fairly easy to map the maze out once you've determined where the teleports occur. This is best done by not picking up any of the objects, and using them as landmarks. You will also find some magic words, to transport you round the maze, and a square in which everything becomes squashed. This will result in death. You will find a way of preventing this square from killing you, but there is also a way you can use this square to your advantage.

Labyrinth and Deathmaze were popular, thinks Denman, because of their appealing graphics and speed. An adventure with pictures adds to the appeal, and many other authors have tried similar programs, most of which fail due to lack of plot and suspense. Mad Hatter Software published a BASIC program with both graphics and sound effects, but the storyline wasn't worth it.

Scott Adams initially



The inmates of Asylum II are sometimes helpful. They can be easily distinguished from guards as they don't wear a sash.

maintained his programs were good enough without graphics, but has obviously changed his mind, because there are now versions of all his adventures with Hi-Res Apple graphics.

ASYLUM

Med System graphics were further refined when the next game, Asylum, was written, and so too were the language facilities. In Asylum it is possible to list the entire vocabulary of the game. This takes three complete screenfulls! No longer do you have to scratch your head looking for the right verb. This is really very useful, and it's a shame more programmers aren't prepared to use it. There is an advanced interpreter, which understands such commands as GIVE THE FLIES TO THE FISHERMAN or GET EVERYTHING UNDER THE BED EXCEPT THE ANCIENT KEY. To save time and typing, many of the common words, such as OPEN, GET and DROP can be abbreviated to one letter.

Asylum is set in a Mental Hospital, and in your travels you come across guards and other inmates. These can be seen on the screen, and many of them will speak to you, or interact in other ways. Once they have offered you their services, they will then ignore you. The game starts with you alone in a room, and you have only a hand grenade for company. Once you get out of your room, you can start to walk the corridors, and will see a number of doors, which you cannot yet open, although you can hear things coming from behind them. For instance, an inmate can be heard behind one shouting "Let me out and I'll kill you!". Later on you will find the key to his cell, if you want to release him! Some of the doors lead to the Guards Quarters, where inmates are forbidden. There are also doors leading off into vast mazes — one of these is ▶

larger than the entire Deathmaze plan. In the mazes you will find more objects. Asylum is played in real-time. You start the game in the morning, and at 5.00 in the evening, if you have not escaped the guards will catch you. This gives you about eight hours playing playing time. Because of the speed of the program, this is a true eight hours — you don't need to wait another two hours for it to interpret every instruction.

The plot of Asylum is one of the best I have played, and it is one of the few adventures that can be replayed after you have solved it and still present a challenge. There are many red herrings, which lead to death by shooting, drowning or lobotomy. The other inmates that one comes across all have little quirks and idiosyncracies (it would be going too far to say that they were almost human), and they make little comments which are either extremely obscure clues or just plain rude. The strange face at the window looks out and, with no provocation, says 'Boy, you're ugly!' (and I couldn't see my reflection in the mirror to disprove him).

Mapping the maze is straightforward, but in the main corridor the Janitor cleans the corridor and so prevents you from dropping objects as markers. There is also a carpenter who turns up at a few places and builds a wall behind you so that you can't necessarily get back the way you came! Asylum tells you when events like this have happened, and the HELP command is sometimes quite useful too.

ASYLUM 2

Asylum 2 is the latest offering. The graphics are improved yet again, and many of the doors have placards to warn you where the Psychotherapist, Electro-shock and the Plastic Surgeon are based. There are rats which you can see on the screen, which are hungry for your flesh. It is possible to use sentences with two verbs, such as GET THE AXE AND KILL THE MURDERER. Many of the problems in Asylum 2 are similar to those in Asylum 1, but there is a new intake of lunatics, one of whom is the author himself. (Didn't Hitchcock put himself in his films? Hitchcock is certainly in Asylum 2).

In Asylum 2 there is a door clearly marked 'Doctors Only'. Needless to say, walking through this door in your usual state gives the guards an excuse to send you to Electro-shock for some punitive treatment. But as a passing inmate helpfully tells you, if you dress like a doctor you will be allowed into the medics' quarters. This, then, is your aim. What happens after that I shall leave for you to discover, if you can get that far!

All the adventures were written for the TRS-80 Model 1 and 3. They will all fit into 16K, but 32K versions are available with more verbose messages. There are plans to make them available for other machines, and Asylum has been released for the IBM. They are currently working on versions for the Apple, Atari and Dragon. William Denman is sceptical about whether they could be transferred to any of Sinclair's products, because he doesn't think it could run fast enough. He's working on it, though, because he reckons Sinclair will be selling an awful lot of computers in America next year. So far, Asylum has sold "thousands" of copies. Frank Corr is now working on Deathmaze 7000, and they are also bringing out more 'text-based' programs.

Deathmaze 5000, Labyrinth, Asylum and Asylum 2 are available from a number of retailers in this country, or direct from Med Systems (they take credit-card orders) at PO Box 2674, Chapel Hill, N. Carolina (Tel. 0101-919 933 1990).

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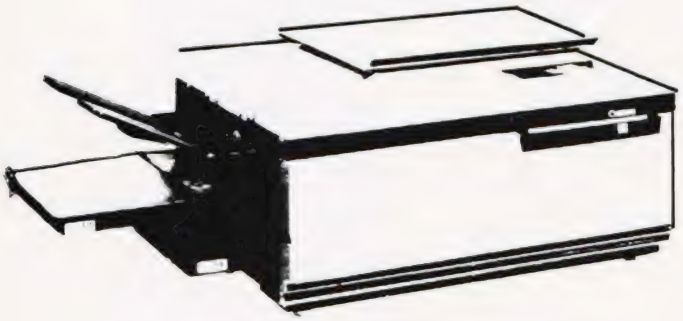

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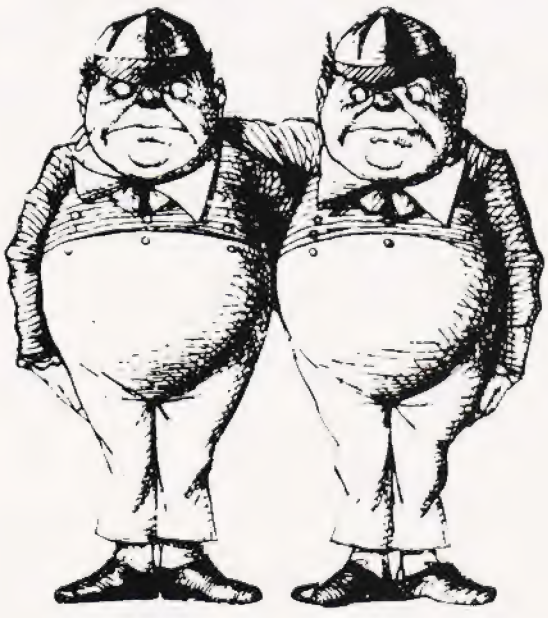

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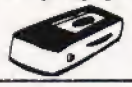

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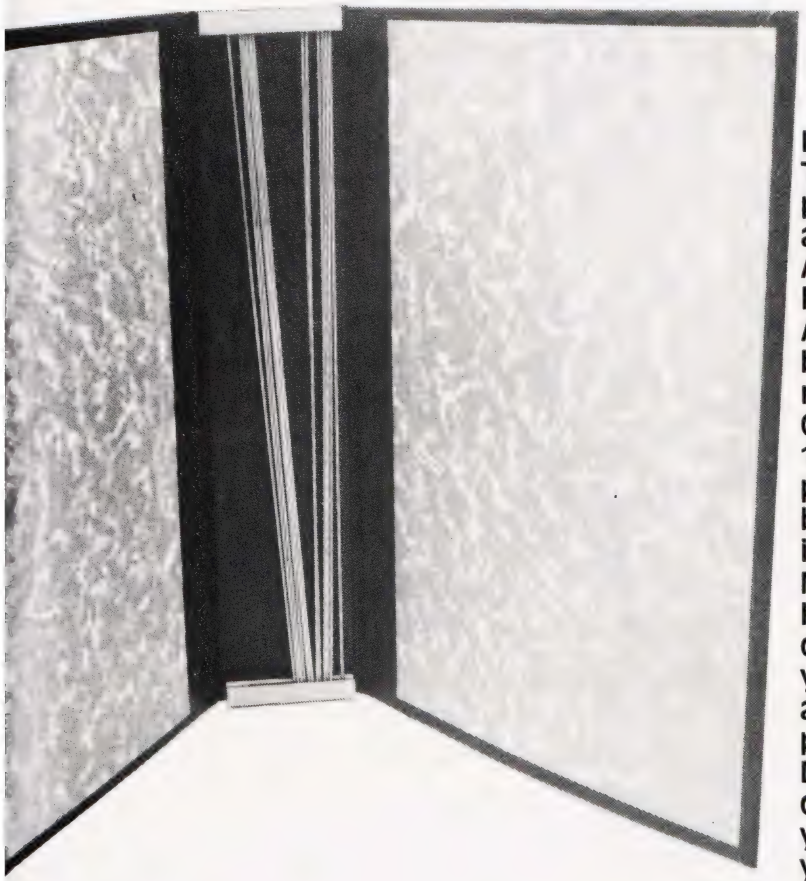

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PASCAL PROFILE

In our fourth and final episode we turn the world on its head and create a Tiny BASIC interpreter using the techniques we have learnt in Pascal!

In the last three articles we have examined the syntax of the Pascal programming language — this month in the final article of the series we will put the language to use, explaining how a complex program to interpret BASIC (similar to the program stored in most microcomputer ROMs) can be written in Pascal. If you've ever wondered how a BASIC interpreter works, this listing should demonstrate most of the principles. The program also illustrates the way in which Pascal allows a complex task to be split up and programmed in simple steps.

TINY BASIC

The BASIC interpreter has been deliberately simplified to avoid filling the whole of this month's issue with the listing! Although the program is small (see Listing 1) it provides a complete BASIC system, allowing programs to be edited, listed and run in the usual way. The interpreter recognises nine statements, listed in Table 1. It allows integer (whole number) arithmetic using 26 numeric variables. Complex expressions such as A = (B+C)/100 − (2 − (F *9)) are allowed, and variable names may be any length (although only the first character is significant — ANTELOPE always equals AARDVARK, for example). Multi-statement lines are allowed.

PRINT . . . prints the value of variables, or text items in quotes, separated by semi-colons.

```
PRINT "Answer = ";ANSWER;"
+/− 1" : PRINT
```

IF . . . subsequent statements on the line are not executed if the condition has the value 0 (FALSE).

```
IF COUNT *12 = (TOTAL +
1)/2 PRINT "Sorry"
```

INPUT . . . reads numbers from the keyboard into variables, separated by semi-colons.

```
INPUT X;Y : PRINT "Enter start";
: INPUT ST
```

GOTO . . . tells the interpreter to start executing the instructions on a different line.

```
GOTO 1000
IF OPTION >3 GOTO 32000
```

END . . . tells the interpreter to stop running the program.

```
END
IF QUIT END
```

REM . . . indicates that the rest of the line is a comment, to be ignored by BASIC.

```
REM This is a comment
```

RUN . . . sets all variable values to zero and starts program execution (a start line may be specified)

```
RUN 100
RUN
IF A=2 RUN
```

LIST . . . displays the current program on the screen.

```
LIST
```

NEW . . . deletes all the lines of the current program and sets all the variable values to zero.

All other words are assumed to be variable-names.

```
TEST=12 *(COUNT−2)
FAIL=COUNT< MIN
```

Table 1. Tiny BASIC statements and examples.

After setting up the data-areas the main routine (at the end of the listing) goes round and round in a loop. It keeps calling GETLINE to read a line typed by the user until something has been entered. Then BASIC looks at the line typed, using SKIPJUNK to skip over any spaces at the start of the line. If the first non-space character of the line is a number the program calls NEWLINE to process a new line of BASIC. Otherwise EXECUTE is called, and tries to identify the line as a BASIC command.

After NEWLINE or EXECUTE has been called BASIC checks the value of a variable named ERROR. If ERROR is not zero then something has gone wrong and an appropriate message must be printed. Procedure ERRORMESSAGE prints a message depending upon the value of ERROR, and then ERROR is cleared. BASIC is caught in a loop which says 'REPEAT . . . UNTIL FALSE'. Since FALSE never has the value TRUE (!) it carries on looping until the Pascal program is stopped.

THE EDITOR

The routine NEWLINE uses READNUMBER to find out the number of the new program line. It then calls DELETE to erase any line which may already have that number. If the user typed some text as well as the number NEWLINE copies the text into the array PROG, which is used to store the BASIC program.

PROG is set up at the start of the program. It is an array of records — each record describes one line of the program. The structure of PROG is vital to the workings of the interpreter. Each element of the array holds four pieces of information — the line number, LNUM, the text of that line, CODE, and the positions of the previous and next lines in the array, LAST and NEXT. At first sight the last two items seem

unnecessary — why can't the interpreter just store the lines in numeric order?

The problem is that Tiny BASIC must allow any line number from 1 to MAXINT to be typed in. On most microcomputer Pascal systems MAXINT will automatically have the value 32767 — the MAXimum INTeger value. If we wanted to store the lines in order we'd either have to set up 32767 array elements (one for each possible line number!) or move all the existing program lines up and down in PROG when new lines were deleted or inserted. The first alternative would take up a great deal of memory (well over a million bytes) and the second would be very slow. We get around both problems by using a slightly more complicated way of storing the lines. Table 2 illustrates the way Tiny BASIC would store a short program in PROG.

POS'N	LNUM	LAST	NEXT	CODE
0	0	5	2	
1	0	0	1	PRINT"TRY"
2	10	0	6	PRINT"YOU"
3	25	6	7	PRINT"GOT"
4	0	3	0	PRINT"ANSWER"
5	40	7	0	PRINT"RIGHT"
6	15	2	3	PRINT"HAVE"
7	30	3	5	PRINT"IT"

Table 2. Tiny BASIC program storage.

Notice that position 0 of the array is a dummy. Tiny BASIC uses element 0 to store the position of the first line of the program (PROG(.0.).NEXT tells us that the first program line is stored at position 2. Just to re-assure us, PROG(.2.).LAST points back to position zero, where we came from. PROG(.2.).NEXT sends us to line 5 for the next statement . . . and so on. Trace through the lines. When you come to the end of the program you will find that the last line has NEXT = 0. That indicates that there are no more statements.

If you want to check that you got the right answer, arrange the lines in numeric order using LNUM. You should end up with lines 10, 15, 25, 30, 40. The lines with LNUM = 0 are unused parts of the list — statements that have been deleted. In fact we can now work out a rule for deleting lines — simply follow through the list until you come to the appropriate line number, then set the previous line's NEXT to point to the next line and set the next line's LAST to point to the previous line. Now the list skips over the line we found, and we can set its LNUM = 0 to mark the fact that the line is out of use. That's the purpose of routine DELETE in the listing.

To add new line the imaginatively named NEWLINE procedure scans through PROG (ignoring the pointers) until it finds an unused line. It sets up the new line number, copies the code, and then searches the list for a line with a number greater than our new line. The next step is slightly complicated to explain, although simple in practice. Let's call the line to be added NEW LINE, and the line with a number just greater than it FOLLOWING LINE. The line that used to precede FOLLOWING LINE will obviously now have to precede NEW LINE, so we'll call it PREVIOUS LINE. To add NEW LINE into the list we:

1) Set NEW LINE's LAST pointer to FOLLOWING LINE's LAST.
2) Set NEW LINE's NEXT pointer to the position of FOLLOWING LINE.
3) Set PREVIOUS LINE's NEXT pointer to the position of NEW LINE.
4) Set FOLLOWING LINE's LAST pointer to the position of NEW LINE.

That seems very complicated at first sight but it isn't really. Try to follow through the steps, adding a new line 35 PRINT "ABSOLUTELY" to the lines in Table 2.

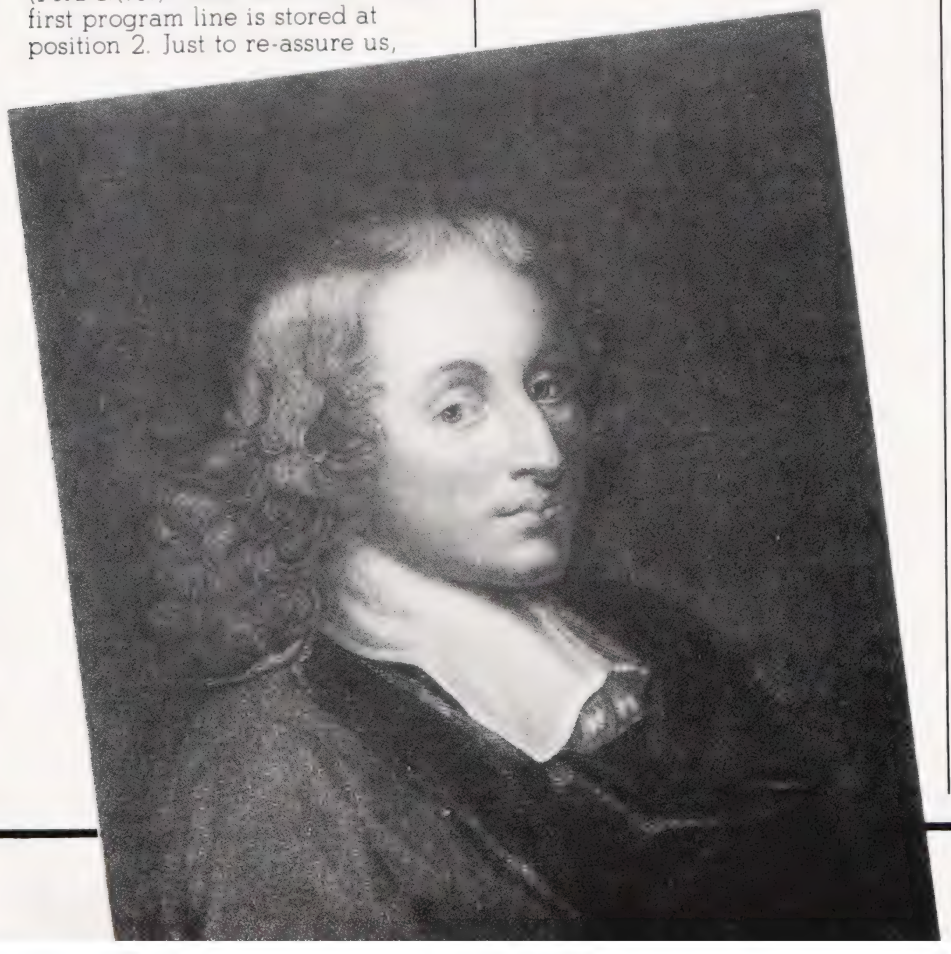
THE INTERPRETER

The procedure called EXECUTE is the main routine of the interpreter. It loops until a variable called RUNNING becomes set to FALSE, passing statements one by one to the instruction-recogniser STATEMENT.

STATEMENT is set up in rather an odd way. The header of the routine is separated from the code. This is because most of the interpreter routines need to use two variables declared at the start of STATEMENT. These are LINE, used to hold the current line of BASIC, and POSN which indicates the next character to be looked at in LINE.

Notice that procedure XIF, one of the routines called by STATEMENT, can call itself! An IF statement takes the form "IF condition statement " . . . but IF is a statement, so that the interpreter must be able to handle IF A = 3 IF B = 3 IF C = 3 PRINT "RUBBISH". Pascal allows you to code this in the obvious way — every time you expect a statement you call STATEMENT, passing it the line and position. It doesn't matter if one of the routines inside STATEMENT calls STATEMENT again. Sooner or later the routine will either come to a statement that isn't an IF or find an error. Either way it will eventually stop chasing its own tail. If you write a routine like this (technically called a 'recursive' routine) you have to be careful that you can't carry on round and round for ever!

Another recursive routine is called EVALUATE. This routine demonstrates a simple way of working out the value of a large expression like A = 45 *(A + 9) − B/4. The problem is that the BASIC language uses normal algebraic rules, which state that ▶



when you try to fathom out the value of an expression you must first work out the value of the parts in brackets, then do all the multiplication and division, and leave the addition and subtraction till last. In BASIC we have another rule, since we can compare values using symbols (technically called 'operators') such as '>' and '='. Such comparisons must be done last of all.

The problem comes when we try to make sure that a computer does everything in the right order. It would be easy to just work from right to left, applying each value and operator to the 'running-total', but that wouldn't always give the correct answer. Table 3 illustrates the solution to this problem. We simply declare a 'large expression' to be made of either an expression (normal-sized) or two expressions with a comparison operator (less, equal, greater) between them. Now we can call an 'expression' an optional '–' (to allow for the meaning 'negative' rather than 'minus') and then either some arithmetic or two lumps of arithmetic with a '+' or '–' sign between them. We define 'arithmetic' as a sub-expression, or two sub-expressions with '*' or '/' between them, and we end up with a puzzled expression!

In fact all we've done is broken up a large expression into lots of pairs of values, each with an operator between them. The function APPLY in Listing 1 can be used to apply the operators in this simple instance. At the very bottom of the list we've declared that a sub-expression is either a variable (which we can find in the VARIABLES array) or a number, which READNUMBER will convert from text into an integer. The only other possibility is that we might run into a bracket, in which case we know that it must enclose another expression — so we can recursively call back again to work that out!

The important thing is that we have forced the computer to use the correct order of evaluation. The computer can't work out the value of a comparison until it has checked for addition and subtraction. Then it must go through the stage which applies multiplication and division, and it can't compute the value of a multiplication until it has checked for brackets.

APPLY contains checks to set ERROR if division by zero is attempted or the result of a calculation exceeds MAXINT or is less than –MAXINT. Notice that Tiny BASIC sets up the value 1 if an expression is true and 0 if it is false: try PRINT 1=1 and PRINT 1=2.

Most of the other interpreter routines are fairly easy to understand. SCAN returns the next character from a line, unless it is a number, in which case SCAN returns 'g' and sets up NUM with the value of the number. If SCAN finds letters it assumes it has encountered a variable-name and passes back the first letter, skipping over the rest. XLIST uses Pascal number formatting to display line numbers tidily — the ':5' in the first WRITE statement tells Pascal to output the line number in a gap at least five characters wide, adding leading spaces if necessary. Similarly the':1' in XPRINT tells Pascal to print a number without leading or trailing spaces.

The ORD function is equivalent to BASIC's ASC and TRUNC converts decimal to integer values, like INT in BASIC. EOLN(INPUT) is a standard Pascal function used by READLINE to detect when all of a line of input has been read. I is declared as a global rather than a local variable due to a bug in my Pascal compiler — strictly speaking I should be declared as local to procedure NEWLINE, but if I do that the program won't compile! Apart from that the entire program is in standard Pascal, and should run on any full Pascal system. RETURN, the end-of-line marker, is set up as a variable rather than a constant because standard Pascal does not allow any functions (eg CHR) to be used in a constant declaration.

LARGE EXPRESSION:	EXPRESSION or LARGE EXPRESSION ('=', '<', '>') another LARGE EXPRESSION
EXPRESSION:	(optional '–' sign) ARITHMETIC or ARITHMETIC ('+', '–') more ARITHMETIC.
ARITHMETIC:	SUB-EXPRESSION or SUB-EXPRESSION ('*', '/') SUB-EXPRESSION.
SUB-EXPRESSION:	VARIABLE-NAME or NUMBER or OPEN-BRACKET EXPRESSION CLOSE-BRACKET.

Table 3. How to break up arithmetic expressions.

ENHANCING TINY BASIC

Tiny BASIC was cut down from a larger BASIC interpreter written in Pascal — it provides a usable framework for a much larger interpreter. Functions cut out include abbreviated keywords, full error indication (showing where in a line an error was found), and a TRACE facility which printed PROG(.CURRENTLINK.).LNUM as each statement was executed. A DELETE command could be added (it can call UNLINK repeatedly) as could SAVE and LOAD commands (using LIST to a file and NEWLINE for data taken from a file). GOSUB and RETURN had to be omitted to simplify the listing, but they could easily be replaced. EVALUATE could be modified to handle AND, OR and NOT. Other possibilities include AUTO, RENUMBER, LET and THEN instructions, or whatever BASIC keywords you prefer.

The most complicated change would involve altering Tiny BASIC to permit floating point arithmetic, strings and arrays. These features could be added but to be efficient they will involve programming beyond the level of this short series.

WHAT NEXT?

In the course of this series we've attempted to explain most of the fundamental principles of Pascal programming. The main points which we've missed out are the use of pointer variables, NEW and DISPOSE, plus an explanation of Variant Records. In fact many micro-based Pascal systems do not implement these features anyway. The best way to learn more about Pascal is to actually buy a Pascal system — I use Pascal 80 from Microcomputer Applications but there are other good implementations of the language available for most micros, including the TRS-80, Apple, PET, ATOM and MZ-80K. A ZX Pascal can't be far away now.

If you're a confirmed BASIC programmer I'd recommend **Successful Software for Small Computers** by Graham Beech as a good book about applying Pascal principles to BASIC programming. If you're keen on writing your own language P J Brown's book **Writing Interactive Compilers and Interpreters** is worth reading. It includes examples in both BASIC and Pascal. Unlike most compiler

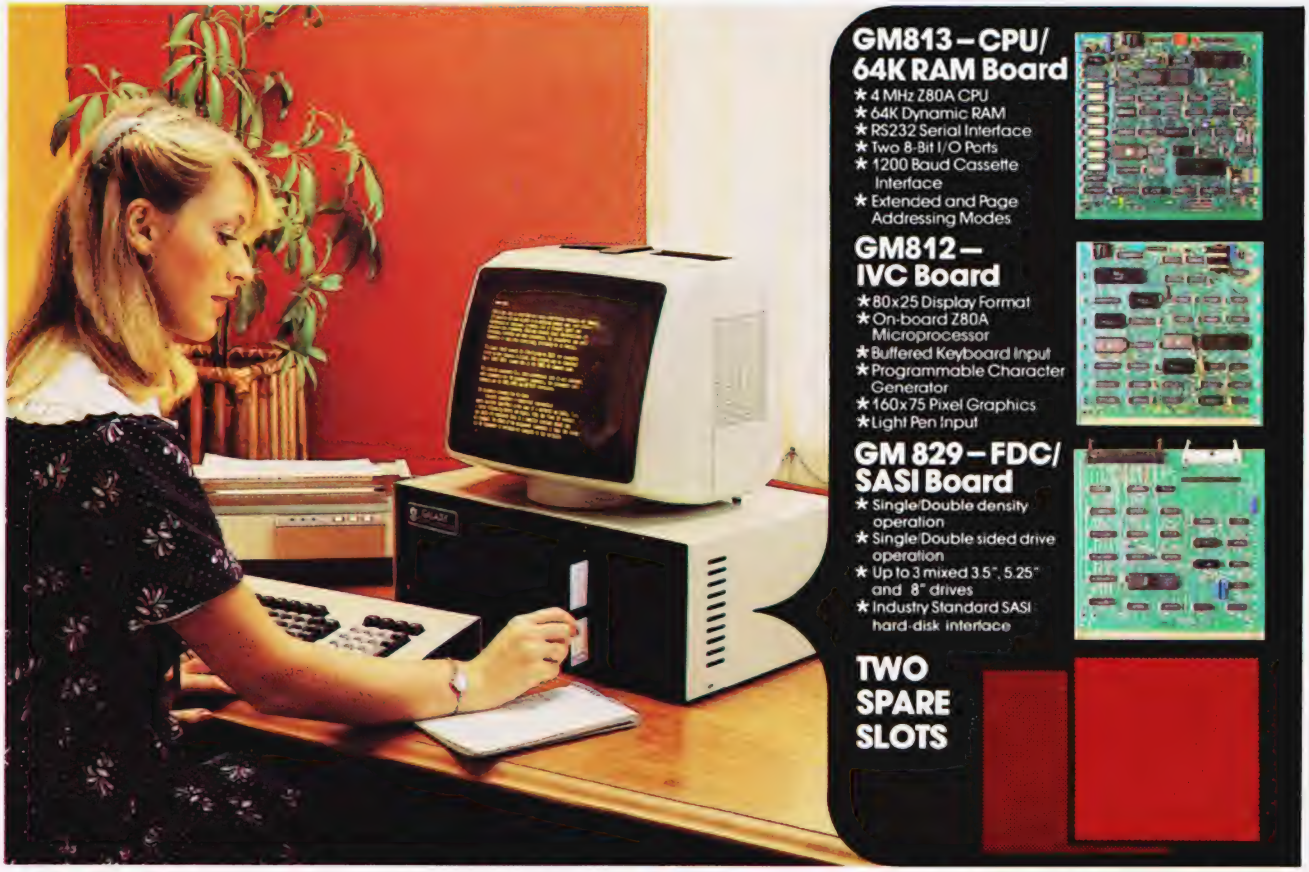
books, it is actually fun to read — I hope I've not committed too many of Mr Brown's fourteen deadly sins in the course of writing Tiny BASIC! The standard text on Pascal is the **Pascal User Manual and Report** written by Kathleen Jensen and Niklaus Wirth (who set the ball rolling in the first place).

```
PROGRAM BASIC(INPUT,OUTPUT);  (* SIMPLE INTERPRETER 1.4 *)
CONST MAXLINES=80; LINEMAX=60; (* BASIC LIMITS *) EMPTY=0;
      NOTVARIABLE=1;  LINESFULL=2; OVERFLOW=3; NOBRACKET=4;
      NOTNUMBER=5; DIVBYZERO=6; NOTSTATEMENT=7; NOSUCHLINE=8;

TYPE STRING=ARRAY [ 1..LINEMAX ] OF CHAR;
     PROGLINE=RECORD CODE:STRING; LNUM,LAST,NEXT:INTEGER  END;

VAR ERROR,POS,LENGTH,NUM,CURRENTLINK,J:INTEGER;
    TYPED:STRING; RUNNING:BOOLEAN; NEXT,RETURN:CHAR;
    PROG:ARRAY[ 0..MAXLINES ] OF PROGLINE;
    VARIABLES:ARRAY[ 1..26 ] OF INTEGER;

PROCEDURE ERRORMESSAGE;
BEGIN   CASE ERROR OF
  LINESFULL:     WRITELN('** NO ROOM FOR ANOTHER BASIC LINE');
  OVERFLOW:      WRITELN('** VALUE OUT OF INTEGER RANGE');
  NOBRACKET:     WRITELN('** ")" BRACKET EXPECTED');
  NOTNUMBER:     WRITELN('** NUMBER EXPECTED');
  DIVBYZERO:     WRITELN('** DIVISION BY ZERO');
  NOTSTATEMENT:  WRITELN('** STATEMENT NOT UNDERSTOOD');
  NOSUCHLINE:    WRITELN('** LINE DOES NOT EXIST');
  NOTVARIABLE:   WRITELN('** VARIABLE NAME EXPECTED')
  END; (* CASE *) ERROR:=0
END; (* ERRORMESSAGE *)

PROCEDURE SKIPJUNK(STR:STRING; VAR POSN:INTEGER);
BEGIN WHILE STR[ POSN ]=' ' DO POSN:=POSN+1 END;

FUNCTION READNUMBER(LINE:STRING;VAR POSN:INTEGER):INTEGER;
VAR VALUE:REAL;
BEGIN SKIPJUNK(LINE,POSN); VALUE:=0; READNUMBER:=0;
  IF LINE[ POSN ] IN [ '0'..'9' ] THEN
    REPEAT VALUE:=VALUE*10+ORD(LINE[ POSN ])-ORD('0');
      POSN:=POSN+1
    UNTIL NOT (LINE[ POSN ] IN [ '0'..'9' ])
      ELSE ERROR:=NOTNUMBER;
  IF VALUE>MAXINT THEN ERROR:=OVERFLOW; (* NOT INTEGER *)
  IF ERROR=0 THEN READNUMBER:=TRUNC(VALUE)
END; (* READNUMBER *)

PROCEDURE GETLINE(VAR LINE:STRING; VAR POSN:INTEGER);
BEGIN POSN:=1;
  REPEAT READ(LINE[ POSN ]); POSN:=POSN+1
    UNTIL EOLN(INPUT) OR (POSN>LINEMAX);
  IF NOT EOLN(INPUT) THEN
    BEGIN WRITELN('LINE TOO LONG.'); POSN:=1 END;
  LINE[ POSN ]:=RETURN;  READLN (* DISCARD ANY REMAINDER *)
END; (* GETLINE *)

PROCEDURE XNEW;
VAR I:INTEGER;
BEGIN  PROG[ 0 ].NEXT:=EMPTY; PROG[ 0 ].LAST:=EMPTY;
  FOR I:=0 TO MAXLINES DO PROG[ I ].LNUM:=EMPTY;
  FOR I:=1 TO 26 DO VARIABLES[ I ]:=0
END; (* XNEW *)

PROCEDURE STATEMENT(LINE:STRING; VAR POSN:INTEGER);
VAR COMM:ARRAY[ 1..5 ] OF CHAR; C:INTEGER;

PROCEDURE SCAN; (* RETURN NEXT SYMBOL IN "NEXT" *)
BEGIN
  SKIPJUNK(LINE,POSN);
  IF LINE[ POSN ] IN [ 'A'..'Z' ] THEN BEGIN
    NEXT:=LINE[ POSN ]; REPEAT POSN:=POSN+1
      UNTIL NOT (LINE[ POSN ] IN [ 'A'..'Z' ]) END
    ELSE IF LINE[ POSN ] IN [ '0'..'9' ] THEN BEGIN
      NEXT:='9'; NUM:=READNUMBER(LINE,POSN) END
        ELSE BEGIN NEXT:=LINE[ POSN ];
          IF NEXT<>RETURN THEN POSN:=POSN+1 END;
  SKIPJUNK(LINE,POSN)
END; (* SCAN *)

(* ARITHMETIC ROUTINES *)
FUNCTION APPLY(NUM1:INTEGER;OP:CHAR;NUM2:INTEGER):INTEGER;
(* APPLY OPERATION 'OP' TO NUMBERS NUM1 & NUM2 *)
VAR COMP:BOOLEAN; RESULT,RNO:REAL;
BEGIN

  IF OP IN [  '<','=','>'  ] THEN BEGIN
    CASE OP OF
      '<':  COMP:=NUM1<NUM2;
      '>':  COMP:=NUM1>NUM2;
      '=':  COMP:=NUM1=NUM2
    END;
    IF COMP THEN APPLY:=1 (* TRUE *) ELSE APPLY:=0
  END
  ELSE BEGIN  RNO:=NUM1; (* FORCE REAL ARITHMETIC *)
    CASE OP OF
      '*':  RESULT:=RNO*NUM2;
      '/':  IF NUM2<>0 THEN RESULT:=RNO/NUM2
              ELSE BEGIN ERROR:=DIVBYZERO; RESULT:=0 END;
      '+':  RESULT:=RNO+NUM2;
      '-':  RESULT:=RNO-NUM2
    END;
    IF ABS(RESULT)>MAXINT THEN BEGIN
      APPLY:=0; ERROR:=OVERFLOW END
    ELSE APPLY:=TRUNC(RESULT) (* CONVERT TO INTEGER *)
  END
END;

FUNCTION EVALUATE:INTEGER;
VAR VALUE:INTEGER;
  FUNCTION EXPRESSION:INTEGER;
VAR VALUE,SIGN:INTEGER;
  FUNCTION ARITHMETIC:INTEGER;
  VAR VALUE:INTEGER;

    FUNCTION SUBEXPRESSION:INTEGER;
    BEGIN  SCAN;
      SUBEXPRESSION:=1; (* ERROR VALUE *)
      IF NEXT='(' THEN BEGIN
        SUBEXPRESSION:=EXPRESSION;
        SCAN; IF NEXT<>')' THEN ERROR:=NOBRACKET END
      ELSE IF NEXT='9' THEN SUBEXPRESSION:=NUM
      ELSE IF NEXT IN [ 'A'..'Z' ] THEN
        SUBEXPRESSION:=VARIABLES[ ORD(NEXT)-64 ]
      ELSE ERROR:=NOTVARIABLE
    END; (* SUBEXPRESSION *)

  BEGIN (* ARITHMETIC *)
    VALUE:=SUBEXPRESSION;
    WHILE LINE[ POSN ] IN [ '*','/' ] DO BEGIN SCAN;
      VALUE:= APPLY(VALUE,NEXT,SUBEXPRESSION) END;
    ARITHMETIC:=VALUE
  END; (* ARITHMETIC *)

BEGIN (* EXPRESSION *)
  SKIPJUNK(LINE,POSN);
  SIGN:=1; (* ASSUME POSITIVE *)
  IF LINE[ POSN ]='-' THEN BEGIN
    POSN:=POSN+1; (* SKIP '-' *)  SIGN:=-1 END;
  VALUE:=ARITHMETIC*SIGN; (* GET THE '/' '*' PART *)
  WHILE LINE[ POSN ] IN [  '+','-'  ] DO BEGIN SCAN;
    VALUE:=APPLY(VALUE,NEXT,ARITHMETIC) END;
  EXPRESSION:=VALUE
END; (* EXPRESSION *)

BEGIN (* EVALUATE *)
  VALUE:=EXPRESSION; (* EVALUATE FIRST EXPRESSION *)
  IF LINE[ POSN ] IN [ '<','=','>' ] THEN BEGIN SCAN;
    EVALUATE:=APPLY(VALUE,NEXT,EXPRESSION) END
      ELSE EVALUATE:=VALUE
END; (* EVALUATE *)
(* END OF ARITHMETIC ROUTINES *)

PROCEDURE XPRINT;
BEGIN (* PRINT OUT VALUE OR TEXT *)
  IF LINE[ POSN ] IN [ RETURN,':' ] THEN WRITELN;
  WHILE NOT (LINE[ POSN ] IN [ RETURN,':' ]) DO BEGIN
    IF LINE[ POSN ]='"' THEN BEGIN (* WRITE STRING *)
      POSN:=POSN+1; (* SKIP FIRST QUOTE *)
      WHILE NOT (LINE[ POSN ] IN [ RETURN,'"',':' ]) DO BEGIN
        WRITE(LINE[ POSN ]); POSN:=POSN+1 END;
        IF LINE[ POSN ]='"' THEN POSN:=POSN+1
    END ELSE WRITE(EVALUATE:1);
    SKIPJUNK(LINE,POSN); IF LINE[ POSN ]<>';' THEN WRITELN
      ELSE BEGIN POSN:=POSN+1; SKIPJUNK(LINE,POSN) END
  END (* LOOP UNTIL END OF PRINT STATEMENT *)
END; (* XPRINT *)
PROCEDURE SETUPGOTO(LINENUM:INTEGER);
VAR I:INTEGER;
BEGIN
  CURRENTLINK:=-1; I:=PROG[ 0 ].NEXT;
  WHILE (I<>EMPTY) AND (CURRENTLINK<0) DO
    IF PROG[ I ].LNUM=LINENUM THEN CURRENTLINK:=I
    ELSE I:=PROG[ I ].NEXT; (* TRY THE NEXT LINE *)
  IF CURRENTLINK<0 THEN ERROR:=NOSUCHLINE
END; (* SETUPGOTO *)

PROCEDURE XRUN;
VAR I:INTEGER;
BEGIN RUNNING:=TRUE; SCAN;
    IF NEXT='9' THEN SETUPGOTO(NUM) (* RUN FROM LINE "NUM" *)
      ELSE CURRENTLINK:=PROG[ 0 ].NEXT; (* RUN FROM START *)
    FOR I:=1 TO 26 DO VARIABLES[ I ]:=0  (* CLEAR VARS *)
END; (* XRUN *)

PROCEDURE XIF;
BEGIN
  IF EVALUATE=0 (* EXPRESSION FALSE, SKIP REST *)
    THEN WHILE LINE[ POSN ]<>RETURN DO POSN:=POSN+1
  ELSE STATEMENT(LINE,POSN) (* CALL YOURSELF! *)
END; (* XIF *)

PROCEDURE XINPUT;
VAR NUM:REAL;
BEGIN (* INPUT TO VARS - NAMES SEPARATED BY ";" OR SPACES *)
  REPEAT SCAN; IF NEXT=';' THEN SCAN;
    IF NOT (NEXT IN [ 'A'..'Z' ]) THEN ERROR:=NOTVARIABLE
    ELSE BEGIN READ(NUM); (* DUMMY IN CASE OF LARGE VALUES *)
    IF ABS(NUM)>MAXINT THEN ERROR:=OVERFLOW
      ELSE VARIABLES[ ORD(NEXT)-64 ]:=TRUNC(NUM) END
  UNTIL (LINE[ POSN ] IN [ ':',RETURN ]) OR (ERROR<>0)
END; (* XINPUT *)

PROCEDURE XLIST;
VAR LIN:INTEGER;
BEGIN
  LIN:=PROG[ 0 ].NEXT;(* GET ADDRESS OF FIRST LINE *)
  WHILE LIN<>EMPTY DO BEGIN
    WRITE(PROG[ LIN ].LNUM:5,' '); POS:=1;
    REPEAT WRITE(PROG[ LIN ].CODE[ POS ]); POS:=POS+1;
    UNTIL PROG[ LIN ].CODE[ POS ]=RETURN; WRITELN;
    LIN:=PROG[ LIN ].NEXT (* STEP TO NEXT LINE *)
  END
END; (* XLIST *)
```

```
BEGIN (* STATEMENT *)
  COMM:='      '; (* 5 SPACES *) C:=1;
  WHILE (C<6) AND (LINE[ POSN ] IN [ 'A'..'Z' ]) DO BEGIN
    COMM[ C ]:=LINE[ POSN ];  POSN:=POSN+1; C:=C+1 END;
  IF C<2 THEN ERROR:=NOTSTATEMENT ELSE
  IF COMM='GOTO ' THEN BEGIN
    RUNNING:=TRUE; SCAN; SETUPGOTO(NUM) END ELSE
    IF COMM='REM  ' THEN (* IGNORE REST OF LINE *)
      WHILE LINE[ POSN ]<>RETURN DO POSN:=POSN+1
      ELSE BEGIN SKIPJUNK(LINE,POSN);
      IF COMM='IF   ' THEN XIF ELSE
        IF COMM='NEW  ' THEN XNEW ELSE
          IF COMM='PRINT' THEN XPRINT ELSE
            IF COMM='INPUT' THEN XINPUT ELSE
              IF COMM='RUN  ' THEN XRUN ELSE
                IF COMM='END  ' THEN RUNNING:=FALSE ELSE
                  IF COMM='LIST ' THEN XLIST ELSE BEGIN
    SCAN; (* ASSIGNMENT *) IF NEXT IN [ 'A'..'Z' ] THEN SCAN;
    IF NEXT<>'=' THEN ERROR:=NOTSTATEMENT
    ELSE VARIABLES[ ORD(COMM[ 1 ])-64 ]:=EVALUATE END
  END
END; (* STATEMENT *)
PROCEDURE EXECUTE(LIN:STRING; POS:INTEGER);
VAR I:INTEGER;
BEGIN
  REPEAT
    SKIPJUNK(LIN,POS);
    WHILE (ERROR=0) AND (LINE[ POS ]<>RETURN) DO BEGIN
      STATEMENT(LIN,POS);
      IF LINE[ POS ]=':' THEN (* MULTI-STATEMENT *) POS:=POS+1;
      SKIPJUNK(LIN,POS);
    END; (* PROCESS STATEMENTS ON LINE *)
    IF ERROR<>0 THEN RUNNING:=FALSE; (* STOP AND REPORT *)
    IF CURRENTLINK=EMPTY THEN RUNNING:=FALSE; (* PROG. END *)
    IF RUNNING=TRUE THEN BEGIN (* STEP TO NEXT LINE *)
      POS:=1; LIN:=PROG[ CURRENTLINK ].CODE;
      CURRENTLINK:=PROG[ CURRENTLINK ].NEXT
    END
  UNTIL RUNNING=FALSE
END; (* EXECUTE *)

PROCEDURE DELETE(NO:INTEGER);
VAR I:INTEGER;
BEGIN I:=0; (* SEARCH FOR LINE *)
  REPEAT IF PROG[ I ].LNUM=NO THEN BEGIN (* FOUND IT *)
    PROG[ PROG[ I ].LAST ].NEXT:=PROG[ I ].NEXT;
    PROG[ PROG[ I ].NEXT ].LAST:=PROG[ I ].LAST;
    PROG[ I ].LNUM:=EMPTY (* MARK LINE AS UNUSED *) END
    ELSE (* TRY NEXT LINE *) I:=PROG[ I ].NEXT
  UNTIL I=EMPTY
END; (* DELETE *)

PROCEDURE NEWLINE;
VAR I,  NO:INTEGER;
(* ADD LINE ENTERED TO PROGRAM - DELETE PREVIOUS IF REDD. *)
BEGIN
  NO:=READNUMBER(TYPED,POS); (* GET LINE NUMBER *)
  IF ERROR=0 THEN BEGIN
    DELETE(NO); SKIPJUNK(TYPED,POS);
    IF TYPED[ POS ]<>RETURN THEN BEGIN I:=0;
      REPEAT I:=I+1 (* FIND AN UNUSED LINE *)
        UNTIL (PROG[ I ].LNUM=EMPTY) OR (I=MAXLINES);
      IF (PROG[ I ].LNUM<>EMPTY) THEN ERROR:=LINESFULL
      ELSE BEGIN (* FIND LINE TO INSERT AFTER *)
        PROG[ I ].LNUM:=NO; J:=PROG[ 0 ].NEXT;
        WHILE (J<>EMPTY) AND (PROG[ J ].LNUM<NO) DO
          J:=PROG[ J ].NEXT;
        PROG[ I ].LAST:=PROG[ J ].LAST; PROG[ I ].NEXT:=J;
        PROG[ PROG[ J ].LAST ].NEXT:=I; PROG[ J ].LAST:=I;
        J:=POS-1;   REPEAT (* COPY CODE *)
          PROG[ I ].CODE[ POS-J ]:=TYPED[ POS ]; POS:=POS+1
        UNTIL TYPED[ POS-1 ]=RETURN;
      END
    END
  END
END; (* NEWLINE *)

BEGIN (* MAIN PROGRAM *)
  RETURN:=CHR(13); ERROR:=0; RUNNING:=FALSE; READLN;
  XNEW; WRITELN('BASIC IN PASCAL 1.4  BY SIMON GOODWIN.');
  REPEAT
    REPEAT WRITE('>');  GETLINE(TYPED,LENGTH) UNTIL LENGTH>1;
    POS:=1; SKIPJUNK(TYPED,POS);
    IF TYPED[ POS ] IN [ '1'..'9' ] THEN NEWLINE
      ELSE EXECUTE(TYPED,POS);
    IF ERROR<>0 THEN ERRORMESSAGE
  UNTIL FALSE (* FOR EVER *)
END. (* BASIC *)
```

Listing 1. The Tiny BASIC interpreter written in Pascal.

GALAXY 2 COMPUTER SYSTEM > WHATEVER REQUIREMENTS YOU HAVE



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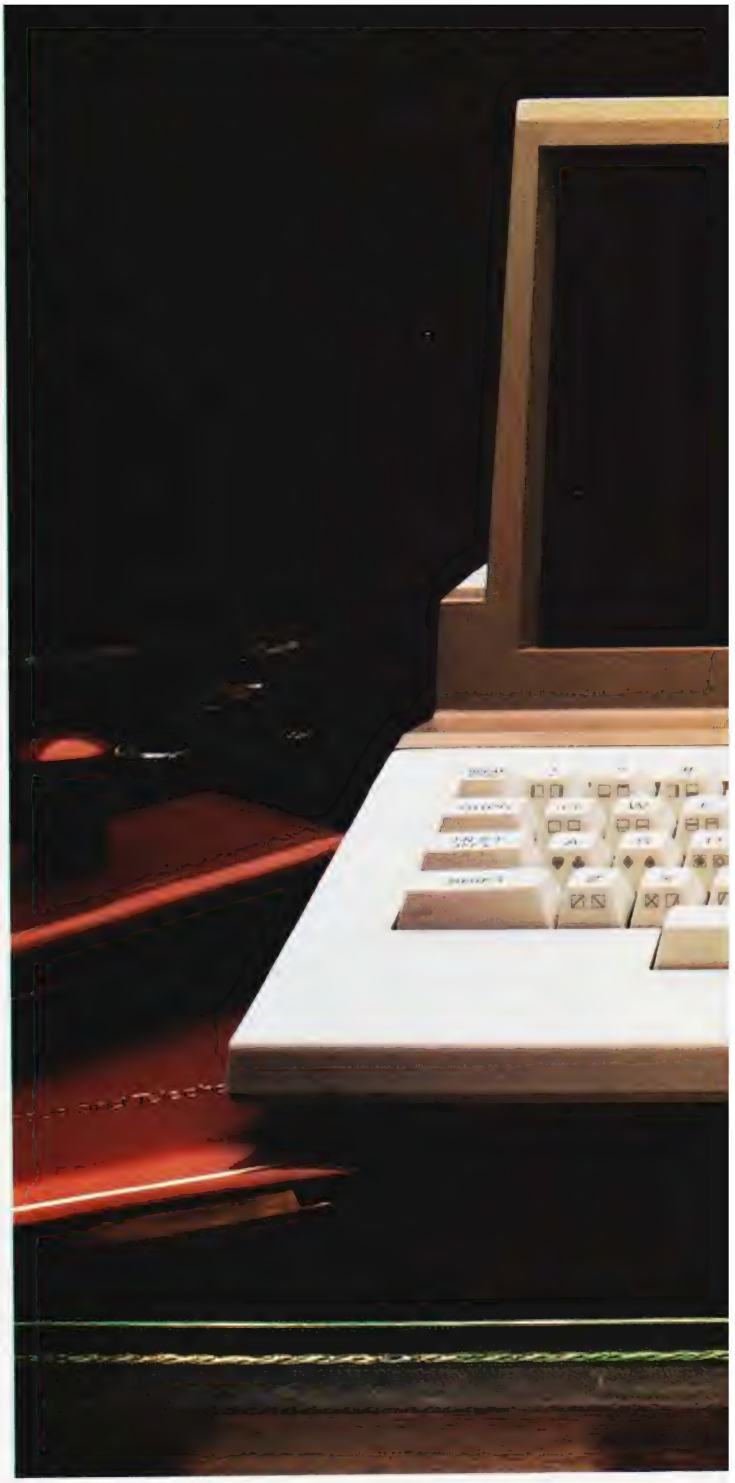

Specifications MZ 80A

CPU	Z 80
Memory	4K-byte ROM; 48K-byte RAM; + 2K-byte Video RAM.
Display	9 inch (23 cm); 40 characters x 25 lines. Green screen.
Cassette	Manual control; standard audio cassette tape. Data transfer (Sharp PWM system): 1,200 bits/sec.
Keyboard	ASC11 keyboard; upper-/lower-case alphabet; graphic symbols; numeric keypad.
Other features	Built-in clock and music function. Auto repeat on all keys. 2-page video RAM (allows the screen to be scrolled up and down). *CP/M available.
Options available	Tape based Pascal Interpreter. Tape based Machine Language package. Sharp FDOS including BASIC compiler. Tape based Z-80 Assembler package.

Printer specifications	Optional Printers MZ 80P4	MZ 80P5	MZ 80P6
Printing method	Serial impact dot matrix		
Feed method	Variable sprocket; Friction	Variable sprocket	Variable sprocket; Friction
Kinds of characters	230		
Character make-up	9(W) x 8(H) dot matrix (normal-size characters)		
Number of digits	136/68 per line 160/80 per line	80/40 per line 136/68 per line	
Printing speed	150 cps (normal-size characters)	80 cps (normal size characters)	
Head sweep direction	Bi-directional		
Other functions	• Software-controlled full graphic function • Programmable number of lines per page • Battery-operated memory of HOME position (MZ 80P4 only)		

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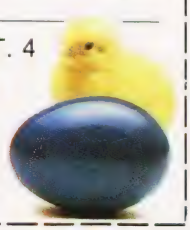
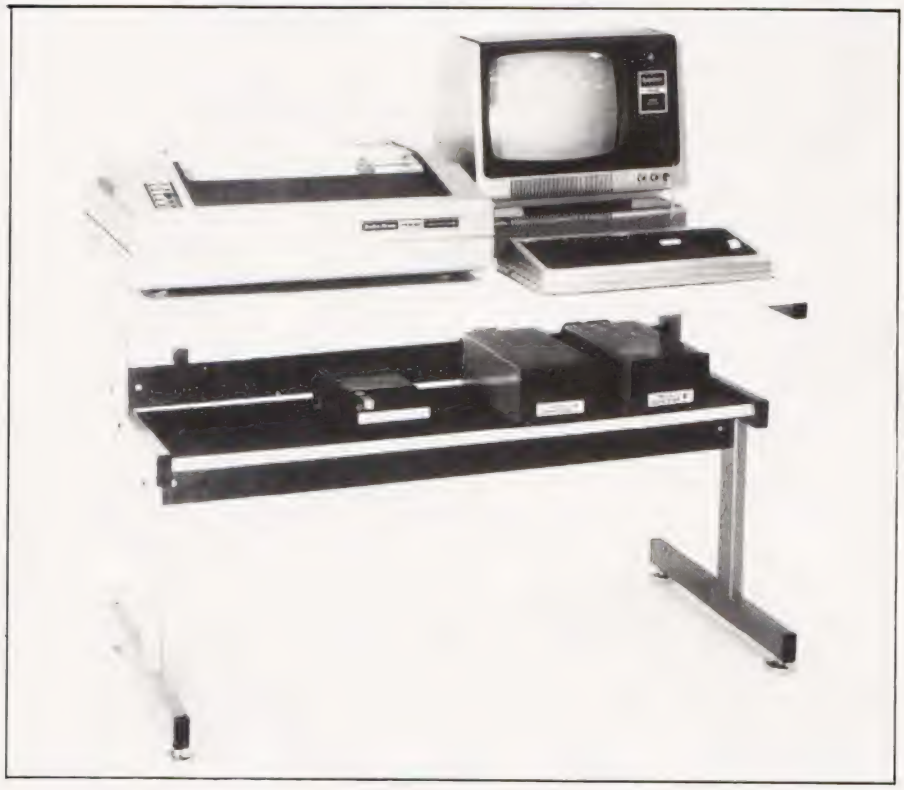


*CP/M is a trademark of Digital Research Ltd.

Tony Lacy

A MICRO DATA BASE

Programs are given here to set up and retrieve information from a data base.



I have a number of interests which cause me to collect journals, books, magazines and so on. Often the item I need to refer to is not to hand and so a search is started and one of several things may then happen. The item may be found, the original subject of the search is forgotten, the whole house is ransacked and, eventually, the search is abandoned.

THE SOLUTION

Simple, write a program to keep track of everything! Well that's the original idea; what follows next is a history of the evolution of this idea into the monster listings which accompany this article, and may help to explain some of the features of the program.

The next stage was to get some sort of specification down on paper. This took quite a while, and many changes were made before I was satisfied. Here is the specification which was finally arrived at:

1) Input a word or short phrase describing the required item (I shall refer to this as the keyword).

2) Quickly display information such as the location, and other comments about the item (I shall call this the data record).

3) Reference several data records with one keyword.

4) Several keywords may reference one data record.

5) Must be able to make additions, deletions and changes.

6) To be limited only by the system hardware, that is, memory and disc space; warnings to be given before these limits are reached.

7a) The program to be self initialising, the only user command to be RUN PROGRAM or, better still, to run under DOS AUTO command. The user would simply insert a diskette, turn on the computer and wait for the program to be up and running.

7b) The program to be easy to use, it must get on with the job with a minimum of fuss, and must clearly indicate when it is waiting for an input.

As you will realise, I have specified a complete data base management system, more bells and whistles could have been added to the specification, but I was already getting the uneasy feeling that I was embarking on quite a large project and some restraint was needed. The next task was to decide on the best way of organising the program and data to achieve the above specification. Wrong decisions made at this point would be difficult to remedy later so a fair amount of thought was needed here. The data would be stored on disc and any method which involved a sequential search through disc files would take too long, and so would any method which involved sorting records on disc. The textbooks were consulted to find a speedy way of accessing the required data records.

HOW THE PROGRAM WORKS

The program uses an index to keep track of disc data, this index is loaded into memory at the start of program execution. Any changes to the disc data are also noted in the index, and this is written back to disc when the program ends. The index is an unordered list of keywords and record numbers, a linear search is made by a machine code routine (USR2) for the required keyword. If the keyword is found then the associated record numbers are passed back to the BASIC program, and random access is used to obtain the correct record from disc. If this were all done in BASIC a list search of a few hundred items could take several minutes. During program development large dummy indexes were constructed and the search routine would return record numbers in less than a second (record numbers near the index end and searching from index start). The speed of data access in the initial trials seemed too good to be true and I soon found the snags ▶

with this method. Here then is the bad news, COMPLEXITY.

The data base and the index must always correspond exactly and to maintain this relationship means that a lot of housekeeping has to be done by the program. There are many traps for the unwary, but I think I have found most of them . . . the hard way.

DATA STRUCTURE

Although some DOSs allow 256 byte sectors, I have assumed that 255 bytes is the maximum in this program (more about this later). The data records are stored in ASCII form, and four data records of 63 characters each are stored per sector, each sector corresponds to a physical record. The position of each data record in the sector is given by a sub-record number, both the sub-record and physical record numbers are encoded into a single number called a logical record number and it is this number which is stored in the index.

The data record length chosen is a compromise since a diskette can contain lots of small records or a few large records. If 63 characters is not enough then the information could be spread over several data records all accessed by the same keywords.

Logical record number 1 is the exception, since it does not contain ASCII data; some system information is stored here in compressed format. It is a list of recently deleted logical record numbers, and the program will use these 'gaps' up before it enlarges the file.

The index is stored in a separate file, and is automatically loaded into reserved memory by the program, it is sequential and contains its own terminator characters. A pair of nulls indicates that the next characters are a keyword in ASCII form, a keyword will terminate in a carriage return. Further byte pairs are interpreted as logical record numbers in integer compressed format (LSB/MSB) up to the next pair of nulls. At the start of the index a few bytes are reserved to tell the program where the index end is.

The listings look a bit daunting don't they? Well actually when you remove the REM statements (which you must do to avoid OUT OF MEMORY errors) it fits comfortably into the area between Disc BASIC and the start of the reserved memory area, about 4 or 5K depending on what DOS you use. Similarly, the assembly code listings are packed full of helpful (?) comments, the object code occupies a mere 500 or so bytes.

BASIC PROGRAM

The program is written as a series of well defined modules, and is crammed with comments. I will further explain some sections, especially where BASIC has been 'bent' a little:

10-40: A useful method for reserving memory size from within a program, notice the use of the hex constant feature of Disc BASIC. A CLEAR statement is needed to set other memory pointers, but this zeros all variables, so any numerical values must be preserved by poking them into temporary storage for later retrieval. This is the purpose of lines 30 and 270.

60-70: Disc I/O is done by two of the machine code routines, Section 6 in the Radio Shack TRSDOS and the **Disc BASIC Reference Manual** provide lots of useful information on assembly language disc I/O, one of the requirements is for a number of buffer areas. One of these is called the device control block (DCB) and the filespec needs to be in there in ASCII form before the file can be opened or created. That is the function of this section.

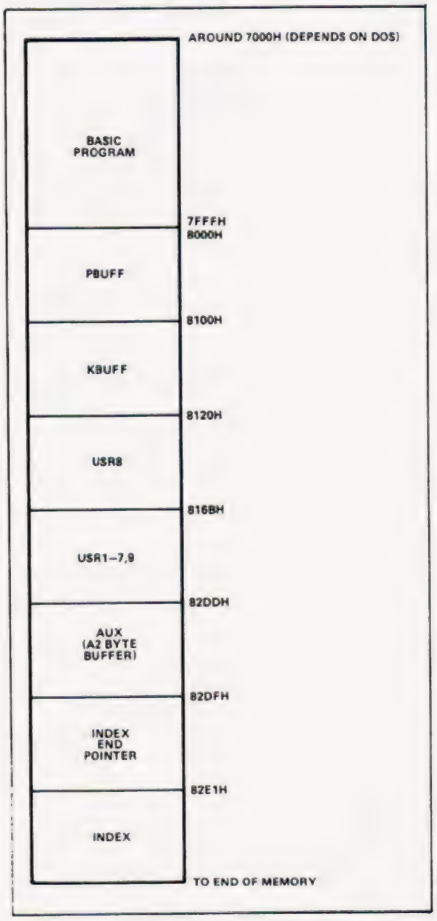


Fig. 1. Memory map of data base system.

110-140: Some errors are dealt with here, for example if the file requested cannot be found we do not want the program to grind to a halt, we just want to be told. On the other hand syntax errors need to be weeded out and corrected. Line 120 restores normal error handling after closing any open files, if an 'unplanned' error occurs.

150: Certain values would normally be read in from disc for updating, if this is a new file they are initialised here instead.

180-250: I am sure you have seen this method before! Numbers are POKEd into specified memory locations, they just happen to correspond to a machine code routine. In this case it is a disc input routine, and is also shown in the assembly listing as USR8. If you look at the first number on line 180 you will see 205, now look at the first byte in the assembly listing CD Hex, that's 205 in decimal!

USR8 and USR9 were written because I wanted to load a file of non-standard format into reserved memory: Disc BASIC's sequential disc I/O tended to chop my index files into pieces. USR8 and USR9 both transfer exact copies from and to disc respectively.

Since I had written a disc input routine for the index, it seemed logical to use it to load in the rest of the machine code routines as well, they could be assembled as a system file and loaded in by USR8 as the BASIC program initialised, right? Wrong! It's not so simple, as a later section will show.

280-360: These lines inform BASIC where the entry points are for the machine code routines.

370: This loads in the machine code routines from a file called USR/DAT, notice that the load point is specified unlike a normal SYSTEM file load.

380-390: The program requests the name of the data base, it will add its own extensions and your password, so these must not be entered here.

430-440: The index is loaded in.

450-530: Fairly straightforward BASIC random file access, logical record 1 is immediately read to check for record deletions (see above). Note the use of

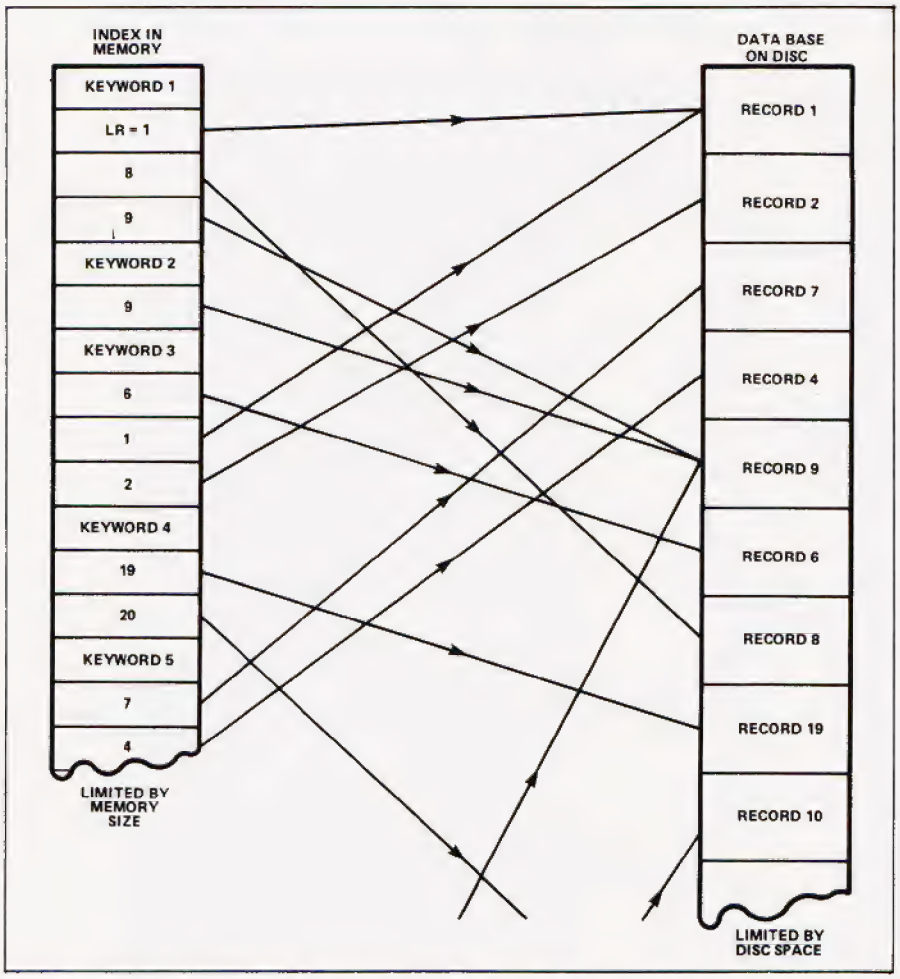


Fig. 2. Examples of: a single keyword referencing several data records (keyword 1); and a data record referenced by several keywords (record 1).

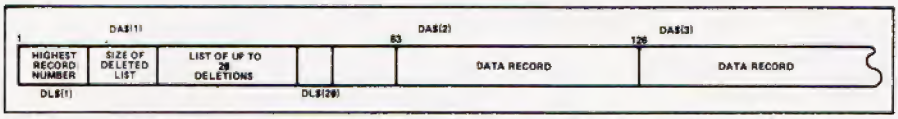


Fig. 3. The structure of physical record 1. The rest of the physical records are simply divided into four data records DA$(1) to DA$(4).

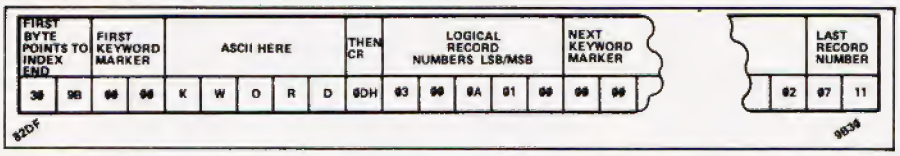


Fig. 4. The layout of the index. The actual byte values are for demonstration only.

overlapping data fields.

540: I am not sure whether the index will fill up available memory, or whether the disc will fill up first, it depends on memory size and on the way that the data base is used. This line will cause a warning to be given when index space is running short, ignore it at your peril.

550-560: The problem here is to find out how much free space exists on the disc. I decided to compute the free space by using the highest logical record number to find the size of the data record file. The size of the index file could be obtained from the in memory size of the index.

The program files are also included in the calculation, and in my case no DOS is present. If the DOS or any other programs are present then the number 67 on line 550 will need to be reduced. The value LG (left granules) agrees with the FREE value obtained from DOS on my system.

570: The only thing you can do with a new file is add to it!

600: The above mentioned menu is displayed, from here on most of the program sections merely pass values between machine code routines, and input user responses. A study of the comments in the assembly listing will be more useful than a line by line description of the BASIC program. After a function is complete the program returns to the main menu, except for EXIT FROM PROGRAM.

NEXT MONTH

In the second, and final, part of this feature we'll be taking a look at the machine code sections of the program. See you then . . .

```
1   REM ** DELETE ALL REMS BEFORE USING PROGRAM
2   REM ** IF YOU INPUT PROGRAM USING AUTO 10,10
    THIS WILL SAVE TIME!
5   REM ** THIS SECTION PARTITIONS THE MEMORY AFTER
    PRESERVING THE ORIGINAL MEMSIZE FOR USE WHEN THE
    PROGRAM EXITS. ONLY ONE POINTER NEEDS CHANGING, A
    CLEAR (NN) WILL DO THE REST
10  CLS:PRINT CHR$(23):PRINT@528,"INITIALISING"
20  PRINT@642,"INFORMATION RETRIEVAL SYSTEM"
30  POKE &H82DD,PEEK(&H40B1):POKE &H82DE,PEEK(&H40B2)
40  POKE &H40B1,255:POKE &H40B2,127
41  REM ** ONCE A CLEAR(NN) HAS BEEN DONE THE ORIGINAL
    MEMSIZE CAN BE STORED AS A VARIABLE MM. ARRAY SPACE
    CAN ALSO BE DEFINED
50  CLEAR 300:DIM DL(20),DL$(22):GOTO 250
51  REM ** SUBROUTINES ARE PUT AT THE START TO SPEED UP
    EXECUTION. THIS ONE PADS OUT A FILESPEC WITH BLANKS
    UP TO 32 BYTES (REQUIRED BY DOS) BEFORE POKEING IT
    INTO THE DCB AREA AT 8100 HEX, SEE LISTING 1
60  FS$=FS$+CHR$(13)+STRING$(31-LEN(FS$),32)
70  FOR I=0 TO 31:POKE &H8100+I,ASC(MID$(FS$,I+1,1)):
    NEXT I:RETURN
71  REM ** WAIT FOR A SINGLE KEYPRESS, RETURN WITH THE
    CHARACTER IN Q$
80  Q$=INKEY$:IF Q$="" THEN 80 ELSE RETURN
81  REM ** DISPLAY THE MESSAGE IN MS$ FOR A PERIOD
    SPECIFIED BY T AND THEN ERASE IT, RESTORE CURSOR
    POSITION
90  PRINT MS$;FOR I=1 TO T:NEXT I:PRINT STRING$(LEN(
    MS$),8);:RETURN
91  REM ** CALCULATE PHYSICAL RECORD, SUB-RECORD WITHIN
    IT AND THEN GET IT
100 PR=INT((LR-1)/4)+1:SR=LR-4*(PR-1):GET 1,PR:RETURN
101 REM ** ERROR TRAPPING ROUTINE, ONLY TRUE ERROR
    CODES 69 AND 53 ARE HANDLED, OTHER ERRORS TERMINATE
    PROGRAM AS NORMAL AFTER CLOSING FILES
110 IF ERR=138 THEN MS$="--ACCESS DENIED, INCORRECT
    PASSWORD":T=800:GOSUB 90:RESUME 380
120 IF ERR<>106 THEN CLOSE:ON ERROR GOTO 0
130 PRINT:PRINT "FILE NAME ";NP$;" NOT FOUND, CREATE IT
    ? (Y/N)"
140 GOSUB 80:IF Q$="Y" THEN 150 ELSE IF Q$="N" THEN
    RESUME 380 ELSE MS$="PLEASE ANSWER 'Y' OR 'N' ":
    T=500:GOSUB 90:GOTO 140
141 REM ** IF THE FILE COULD NOT BE FOUND AND THE USER
    HAS REQUESTED IT THEN A NEW FILE IS CREATED
150 S=1:POKE &H82DF,224:POKE &H82E0,130:LL=2:DN=0:
    RESUME 440
151 REM ** THIS MESSAGE IS DISPLAYED WHEN THE PROGRAM
    IS READY TO ACCEPT A LINE OF DATA OR A KEYWORD
160 CLS:PRINT "TYPE IN YOUR ";Q1$;"THEN <ENTER>, TO
    CORRECT MISTAKES USE '";CHR$(93);"' AND RETYPE
    [83 SPC]***";Q2$;" CHARACTERS MAXIMUM***"
170 PRINT@384,HL$:PRINT@512,HL$:PRINT@448,"";:RETURN
171 REM ** THESE DATA STATEMENTS ARE USR8 ENCODED IN
    ASCII DECIMAL FORM AND ARE PUT INTO MEMORY. ALL OF
    THE OTHER USR ROUTINES ARE IN ANOTHER FILE
    (USR/DAT) AND ARE INPUT BY USR8
180 DATA 205,127,10,34,221,130,33,0,128,17,0,129
```

```
190  DATA 6,0,205,36,68,194,253,99,17,0,129,205
200  DATA 54,68,194,253,99,237,91,221,130,33,0,128
210  DATA 1,0,1,237,176,42,12,129,237,75,10,129
220  DATA 183,237,66,40,12,1,0,1,42,221,130,9
230  DATA 34,221,130,24,211,17,0,129,205,40,68,200
240  DATA 195,253,99,0
250  FOR I=(&H8120) TO (&H816A):READ Y:POKE I,Y:NEXT I
251  REM ** DEFINE A HORIZONTAL LINE
260  HL$=STRING$(63,131)
261  REM ** GET TRUE END OF MEMORY FOR USE WHEN PROGRAM
     ENDS
270  MM=256*PEEK(&H82DD)+PEEK(&H82DE)
271  REM ** DEFINE ENTRY POINTS FOR USR ROUTINES 1-9
280  DEFUSR1=&H82D4:REM ** STRING INTO KBUFF
290  DEFUSR2=&H8253:REM ** GET LOCATION AFTER THE WORD
     IN KBUFF
300  DEFUSR3=&H8286:REM ** ADD KEYWORD TO INDEX END FROM
     KBUFF
310  DEFUSR4=&H82B0:REM ** ADD A RECORD NUMBER
320  DEFUSR5=&H81AA:REM ** COUNT RECORD NUMBER OCCURENCE
330  DEFUSR6=&H823D:REM ** RETURN A RECORD NUMBER OR 0
340  DEFUSR7=&H82A1:REM ** ASCII CHRS FROM INDEX
350  DEFUSR8=&H8120:REM ** READ IN USR AND INDEX FILES
360  DEFUSR9=&H816B:REM ** WRITE INDEX TO DISC
361  REM ** NOW LOAD THEM IN FROM FILE "USR/DAT" LOAD
     BASE ADDRESS IS 816B HEX, USR8 IS ALREADY IN
370  FS$="USR/DAT":GOSUB 60:E=USR8(&H816B)
371  REM ** ASK FOR THE NAME OF THE DATA BASE, (NOT
     FILESPEC)
380  S=0:CLS:PRINT@320,"PLEASE ENTER FILENAME, THEN
     <ENTER>"
390  LINEINPUT NF$:IF NF$="" THEN 380
391  REM ** AND NOW GET THE PASSWORD BUT DON'T DISPLAY
     IT!
400  PW$="":PRINT@448,"PASSWORD PLEASE, THEN <ENTER>"
410  GOSUB 80:IF Q$<>CHR$(13) THEN PRINT "P";:PW$=PW$+
     Q$:GOTO 410
411  REM ** ACTIVATE ERROR TRAPPING BEFORE THE FILES ARE
     OPENED
420  ON ERROR GOTO 110
421  REM ** CONSTRUCT A FILESPEC AND THEN ATTEMPT TO
     LOAD IN THE INDEX FILE
430  FS$=NF$+"/IND."+PW$:GOSUB 60:E=USR8(&H82DF)
440  FD$=NF$+"/DAT."+PW$
441  REM ** OPEN THE DATA FILE
450  OPEN"R",1,FD$
451  REM ** AND FIELD THE BUFFERS, OVERLAPPING FIELDS
     ARE USED HERE SINCE THE FIRST RECORD OF THE DATA
     FILE IS USED FOR DELETED RECORD STORAGE
460  FOR I%=0 TO 3
470  FIELD 1,(I%*63) AS DD$,63 AS DA$(I%+1)
480  NEXT I%
490  FOR I%=0 TO 19
500  FIELD 1,(I%*2) AS DD$,2 AS DL$(I%+1)
510  NEXT I%
511  REM ** S=0 FOR AN EXISTING FILE ELSE S=1
520  IF S=0 THEN GET 1,1:LL=CVI(DL$(1)):DN=CVI(DL$(2))
521  REM ** DN WILL BE 0 FOR A NEW FILE
530  FOR I=0 TO DN:DL(I)=CVI(DL$(2+I)):NEXT I
531  REM ** CHECK ON MEMORY USAGE BY INDEX
540  EI=PEEK(&H82DF)+PEEK(&H82E0)*256:LE=MM-EI
541  REM ** CHECK ON DISC SPACE USED, WARN USER IF
     RUNNING SHORT
550  TG=INT((EI-33503)/1280)+INT(LL/20)+8:LG=67-TG
560  IF LG<5 THEN MS$="--WARNING, DISC ALMOST FULL!!
     ONLY "+STR$(LG)+" GRANULES REMAINING":T=2200:
     GOSUB 90
561  REM ** LIMIT OPTIONS IF THIS IS A NEW FILE
570  IF S=1 THEN 970
571  REM ** PRESENT FULL OPTIONS IF FILE ALREADY EXISTS
580  CLS:PRINT TAB(20)"MAIN MENU[90 SPC]INPUT YOUR
     CHOICE"
590  PRINT "FILENAME-----";NF$:PRINT HL$
600  PRINT "1---CHECK SYSTEM STATUS
            2---LOOKUP/MODIFY RECORD
            3---LIST THE KEYWORDS
            4---EXIT FROM PROGRAM
            5---ADD A RECORD"
601  REM ** WARN USER OF IMPENDING DOOM
610  IF LE<150 THEN PRINT "***WARNING, ROOM FOR ONLY ";
     LE;" MORE CHARACTERS IN MEMORY***"
620  PRINT HL$:PRINT "?---";
621  REM ** GET DESIRED OPTION AND BRANCH TO IT
630  GOSUB 80:ON VAL(Q$) GOTO 650,740,840,920,970
640  T=500:MS$="A NUMBER BETWEEN 1 AND 5 PLEASE":GOSUB
     90:GOTO 630
641  REM ** STATUS CHECK SECTION, A SIMPLE DISPLAY OF
     SELECTED VARIABLES
650  CLS:PRINT "MEMORY SIZE";TAB(30)MEM
660  PRINT "STRING SPACE";TAB(30)FRE(A$)
670  IF DN<>0 THEN PRINT DN" RECORD(S) ON DELETED LIST
     :":FOR I=1 TO DN:PRINT DL(I);"[2 SPC]";:NEXT I:
     PRINT
680  PRINT "END OF INDEX AREA";TAB(30)MM
690  PRINT "END OF INDEX";TAB(30)EI
700  PRINT "ROOM LEFT FOR INDEX";TAB(30)LE
710  PRINT "DISC SPACE USED";TAB(30)TG;" (GRANULES)"
720  PRINT "NEXT RECORD NUMBER";:IF DN=0 THEN PRINT LL
     ELSE PRINT DL(DN)
730  INPUT "<ENTER> FOR MAIN MENU";DD$:GOTO 580
731  REM ** THIS IS THE HEART OF THE PROGRAM. IT
     SEARCHES THE INDEX FOR A GIVEN KEYWORD THEN OBTAINS
     THE LOGICAL RECORD NUMBERS ASSCOCIATED WITH IT
732  REM ** IT THEN GETS THE RECORD FROM DISC AND
     DISPLAYS IT. A LIMITED EDITING FACILITY IS ALSO
     PROVIDED
740  CLS:Q1$="KEY FOR DESIRED RECORD, ":Q2$=" 32 ":
     GOSUB 160
741  REM ** PUT THE KEYWORD IN THE BUFFER
750  E=USR1(E):FF=&H82E1
751  REM ** GET LOCATION FOR FIRST RECORD NUMBER, OR 0
     IF NOT FOUND
760  RR=USR2(FF):IF RR=0 THEN GOSUB 170:INPUT "SEARCH
     COMPLETED <ENTER>";DD$:GOTO 580
761  REM ** EXTRACT THE RECORD NUMBER, OR 0 IF NO MORE
     ENTRIES
770  GOSUB 170:LR=USR6(RR):IF LR=0 THEN FF=RR:GOTO 760
771  REM ** GET AND DISPLAY RECORD
780  GOSUB 100:PRINT DA$(SR):PRINT HL$
781  REM ** SUB-MENU OPTIONS
790  PRINT "<N>EXT <F>INISHED <D>ELETE <A>LTER ":
     GOSUB 80:IF Q$="N" THEN RR=RR+2:GOTO 770
791  REM ** IT IS EXPECTED THAT A DATA FILE WILL GROW,
     NOT CONTRACT, AND SO THE NUMBER OF RECORD
     DELETIONS PERMITTED IS LIMITED
800  IF DN>20 AND Q$="D" THEN INPUT "CAN'T DELETE ANY
     MORE <ENTER> FOR MAIN MENU";DD$:GOTO 580
801  REM ** IF A RECORD IS DELETED THEN SOME
     HOUSEKEEPING IS NEEDED, THIS IS THE FUNCTION OF
     USR5
810  IF Q$="D" THEN POKE &H82DE,0:POKE &H82DD,0:C=USR5
     (LR):DN=DN+1:DL(DN)=LR:MS$=STR$(C)+" REFERENCES
     DELETED,--CONTINUING":T=300:GOSUB 90:GOTO 760
811  REM ** SOME EDITING OF A SUB-RECORD IS ALLOWED, BUT
     KEYWORDS CANNOT BE DIRECTLY DELETED OR CHANGED
     BECAUSE THEY MAY REFERENCE OTHER DATA
820  IF Q$="A" THEN PRINT "TYPE IN THE ALTERED RECORD":
     LINEINPUT RR$:LSET DA$(SR)=RR$:PUT 1,PR:PRINT@512,
     CHR$(31):GOTO 770
830  GOTO 580
831  REM ** THIS SECTION LISTS OUT THE KEYWORDS, THE
     LISTING CAN BE HALTED BY THE USUAL METHOD OF
     <SHIFT>  AND <@> KEYS. THIS SECTION IS PROVIDED
     MAINLY FOR DEBUGGING PURPOSES
840  CLS:EN=USR6(&H82DF)
850  F=&H82E1
860  IF F>EN THEN PRINT:INPUT "DONE <ENTER>";DD$:
     GOTO 580
870  F=USR7(F):F=F+1:PRINT TAB(32)"";
880  IF POS(I)>60 THEN PRINT:PRINT TAB(32)"";
890  RN=USR6(F)
900  F=F+2:IF RN<>0 THEN PRINT RN;" ";ELSE PRINT:
     GOTO 860
910  GOTO 880
911  REM ** IT IS ABSOLUTELY VITAL THAT THE PROGRAM
     EXITS VIA THIS SECTION IF THE INDEX/DATA BASE IS TO
     BE MAINTAINED. THE UPDATED INDEX IS WRITTEN TO DISC
     ANY DELETIONS AND THEIR LOCATIONS ARE ALSO FILED
912  REM ** THIS IS DONE SO THAT THE PROGRAM CAN RE-USE
     THE SPACE WHEN RECORDS ARE ADDED
920  FS$=NF$+"/IND."+PW$:GOSUB 60:E=USR9(E)
930  GET 1,1:FOR I=0 TO DN:LSET DL$(2+I)=MKI$(DL(I)):
     NEXT I
940  LSET DL$(1)=MKI$(LL):LSET DL$(2)=MKI$(DN):PUT 1,1
941  REM ** THE ORIGINAL MEMORY SIZE IS NOW RESTORED
950  M=INT(MM/256):L=MM-M*256
960  POKE &H40B1,M:POKE &H40B2,L:CLEAR 50:END
961  REM ** ADD NEW RECORDS SECTION. THE RECORD TO BE
     ADDED IS EITHER PUT AT THE HIGHEST RECORD+1 OR
     SPACES FROM PREVIOUS DELETIONS ARE USED
970  Q1$="NEW RECORD, ":Q2$="63":GOSUB 160
980  LINEINPUT RR$:IF RR$="" OR LEN(RR$)>63 THEN 970
990  IF DN<>0 THEN LR=DL(DN):DN=DN-1 ELSE LR=LL:LL=LL+1
1000 GOSUB 100:LSET DA$(SR)=RR$:PUT 1,PR
1001 REM ** KEYWORDS ARE INPUT, AND CROSS REFERENCES ARE
     SET UP IN THE INDEX
1010 Q1$=" KEYWORD ":Q2$=" 32 ":GOSUB 160
1020 E=USR1(E)
1030 F=USR2(&H82E1)
1040 IF F=0 THEN E=USR3(E):GOTO 1030
1050 FF=F
1051 REM ** IF THE KEYWORD JUST ENTERED IS A SUBSTRING
     OF ANOTHER KEYWORD FOR THIS RECORD THEN IT IS
     REDUNDANT. A "+" IS DISPLAYED TO SHOW THAT IT HAS
     NOT BEEN ENTERED
1060 LO=USR6(FF):IF LR=LO THEN PRINT@448,"+";:GOTO 1120
1070 IF LO<>0 THEN FF=FF+2:GOTO 1060
1080 PRINT@448," ";
1090 H=INT(LR/256):L=LR-H*256
1100 POKE &H82DD,L:POKE &H82DE,H
1110 E=USR4(F)
1120 PRINT@449,"MORE KEYWORDS ? (Y/N)[19 SPC]";
1130 PRINT@512,HL$;:GOSUB 80
1140 IF Q$="N" THEN 580 ELSE 1010
```

Listing 1. Data base management program in BASIC.


sinclair
ZX Spectrum
BLUE EDIT
RED CAPS LOCK
MAGENTA TRUE VIDEO
GREEN INV. VIDEO
CYAN
YELLOW
WHITE
GRAPHICS
BLACK DELETE
DEF FN
FN
LINE
OPEN #
CLOSE #
MOVE
ERASE
POINT
CAT
FORMAT
SIN
COS
TAN
INT
RND
STR$
CHR$
CODE
PEEK
TAB
ASN
ACS
ATN
VERIFY
MERGE
AND
OR
AT
IN
OUT
READ
RESTORE
DATA
SGN
ABS
SQR
VAL
LEN
USR
STOP
NOT
STEP
TO
THEN
CIRCLE
VAL $
SCREEN $
ATTR
LN
EXP
LPRINT
LLIST
BIN
IN KEY$
PI
BEEP
INK
PAPER
FLASH
BRIGHT
OVER
INVERSE
SYMBOL SHIFT

Sinclair ZX Spectr

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!

First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power– personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um

ZX Spectrum software on cassettes – available now

The Spectrum software library is growing every day. Subjects include games, education, and business/household management. Flight Simulation...Chess...Planetoids...History...Inventions...VU-CALC...VU-3D Club Record Controller...there is something for everyone. And they all make full use of the Spectrum's colour, sound, and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

ZX Expansion Module

This module incorporates the three functions of Microdrive controller, local area network, and RS232 interface. Connect it to your Spectrum and you can control up to eight Microdrives, communicate with other computers, and drive a wide range of printers.

The potential is enormous, and the module will be available in the early part of 1983 for around £30.

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Sinclair Research Ltd, Stanhope Road, Camberley, Surrey GU15 3PS.
Tel: Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

The transfer rate is 16K bytes per second, with an average access time of 3.5 seconds. And you'll be able to connect up to 8 Microdrives to your Spectrum via the ZX Expansion Module.

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

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FREEPOST – no stamp needed. **Prices apply to UK only.** **Export prices on application.**

Sinclair ZX Spectrum–technical data.

Dimensions

Width	233 mm
Depth	144 mm
Height	30 mm

CPU / memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.

16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/speaker.

Graphics

Point, line, circle and arc drawing commands in high-resolution graphics.

16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive–or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

Mathematical operations and functions

Arithmetic operations of +, −, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.

Numbers are stored as five bytes of floating point binary – giving a range of $+3\times10^{-39}$ to $+7\times10^{38}$ accurate to $9\frac{1}{2}$ decimal digits.

Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

String operations and functions

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.

A very powerful string slicing mechanism exists, using the form a$ (x TO y).

Variable names

Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette interface

The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.

IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.

Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY.
ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

sinclair

ZX Spectrum

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Tel: Camberley (0276) 685311.

Mike James

ELEGANT PROGRAMMING

For our grand finale in this series we take a look at a completely different method of tackling problems in programming.

The subject of this final article is the rather grand sounding programming technique called, 'recursion'. You may feel that the last part of a series on programming is an odd place to be introducing yet another programming method! After all, stepwise refinement and structured programming were covered earlier in the series as the only way to write good programs — so what else can there be? The answer is that recursion is almost a wholly separate approach to programming. Simple programming problems are most easily solved using combinations of branch (ie IF statements) and loops. Problems that are best solved using recursion are usually not encountered until much later on the road to becoming an expert programmer and, by this stage, it is often too late to see an alternative way of tackling a problem. This might account in part at least for the trouble that many people have with understanding and using recursion. On the other hand it might just be that recursion is a method of thinking that you either find natural or you don't. Whatever the reason, recursion has a way of making fanatical friends and devoted enemies. A more balanced view is that recursion is just another weapon to be added to the programmers' arsenal and used when appropriate. So, if you have never met recursion or if you have been convinced that it is a difficult technique reserved for academics then read on.

ITERATION V RECURSION

The best way to explain recursion is by example. Perhaps the most used and simplest example of recursion is the calculation of the factorial function. It is a good example not only because it is simple but because it shows clearly the relationship between the programming methods we already know — looping etc — and recursion. The factorial function n! is the product of all the integers from 1 up to and including n. In other words:

$$n! = 1 * 2 * 3 * 4 * 5 \ldots * (n-1) * n$$

If you were set the task of writing a BASIC program to calculate the factorial function then you would probably write something like:

```
10 INPUT N
20 A=1
30 FOR I=1 TO N
40 A=A*I
50 NEXT I
60 PRINT A
```

The main part of the program, ie the part that does all the work is the FOR loop between lines 30 to 50. The usual name for this sort of solution is 'iteration'. Any program that arrives at its solution by going round a loop is known as an iterative program. At this point it may be difficult to see how there could possibly be an alternative to iteration — looping is so fundamental to programming. However there is another equivalent definition of the factorial function that leads directly to a different sort of program that calculates it. If you want to work out n! and you happen to already know what (n − 1)! is then you can take a short cut by using:

$$n! = n * (n-1)!$$

For example $4! = 4 * 3!$. If you don't happen to know the value of $(n-1)!$ then you can use the same idea once more to find $(n-1)!$. That is $(n-1)! = (n-1) * (n-2)!$ You should be able to see that you can keep on using this relationship until you get to a factorial that you do know the value of and then by working your way back up the chain you can return to the value of the factorial that you want. A value of the factorial function that is particularly easy to remember (or work out) is 1! which is of course equal to 1. So, for example, to calculate 4! using this method we would first reduce the problem to finding 3! by $4! = 4 * 3!$. Then we would reduce the problem to finding 2! by $3! = 3 * 2!$ and finally to 1!, which we know by $2! = 2 * 1!$. To get the required answer we now have to work our way back 'up' the chain of calculations ie $2! = 2 * 1! = 2$, $3! = 3 * 2 = 6$, and finally $4! = 4 * 6 = 24$. This, rather strange method calculates the factorial function without any hint of an iterative loop — it is the recursive method of calculating the factorial function. The ideas of 'stepping down' through a calculation until you reach a point where you can replace unknown parameters by actual values and then 'stepping up' through the calculation filling in the previously missing values is characteristic of all recursion. Another feature of recursion is the way that the recursive definition of the factorial function involves itself. That is:

$$n! = n * (n-1)!$$

can be read as a definition of n! in terms of n and $(n-1)!$ In fact it is this self referencing that makes the step down/step up behaviour of recursion possible.

Now that we have an alternative method of calculating the factorial function the next step is to produce a BASIC program that uses recursion. However this is not quite so easy as it sounds.

RECURSION AND BASIC

There are computer languages that are defined and implemented with special features to allow and even encourage programmers to write recursive programs. The trouble is that BASIC isn't one of them! This isn't unreasonable when you think of BASIC's humble origins as a first teaching language. A few versions of BASIC — C BASIC and BBC BASIC for example — contain special facilities for recursion but, in general, BASIC leaves the programmer to sort out recursion alone. Things are not quite so bad, however, because it is fairly easy to write clean and neat recursive programs in BASIC using a simple idea. Before introducing this it is worth looking at the way that a standard recursive program would appear in a version of BASIC that facilitates recursion — BBC BASIC.

What we need to do is take the recursive definition of the factorial function and convert it as directly as possible into BASIC:

```
10 DEF FNF(N)
20 IF N<>1 THEN =N*FNF(N-1)
30 =1
```

Although the above program may look a little strange you should be able to identify the overall form of a recursive subroutine. The first line (10) defines what follows as a function called FNF. The second line (20) is the recursive definition of N! It says IF N< >1 THEN the result of the function is N times the result of FNF(N − 1). You should be ▶

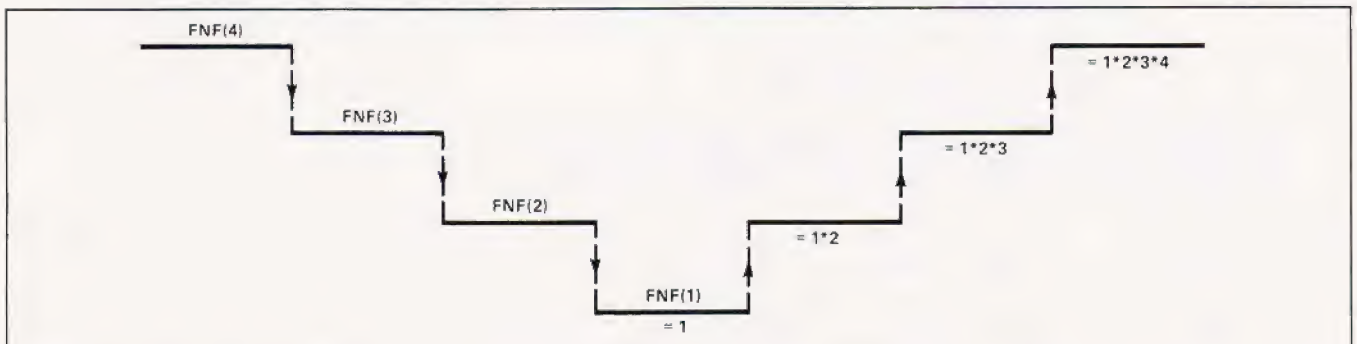

Fig. 1. The calculation of FNF(4).

able to see that this is where the step down/step up calculation occurs. When FNF is used, for example in the statement PRINT FNF(4), line 20 causes FNF to be called as FNF(N− 1), FNF(N− 2) and so on until FNF(1) is reached when line 30 returns the value 1 and the chain of calculations is taken back up towards the first use of FNF. This idea can only work and really be understood if each time FNF is used a completely new version of the function, in particular all its variables, are created anew. For example in the execution of FNF(4) line 20 causes a completely new version of FNF to come into existence to work out FNF(3). This in turn causes another version of FNF to come into existence to work out FNF(2) which finally creates a version to give the value of FNF(1). Not only must a new version of FNF come into existence each time it is used, each new version must only replace the previous one until it returns a result. In other words to allow the calculation to work its way back up the chain it is necessary for each of the versions of FNF created on the way down the chain to carry on existing both to accept the results of the later versions of the function and to return a value to any earlier versions of the function. So to continue the above example, when FNF(1) returns the value 1 as its answer, it passes it to the partially completed version calculating FNF(2). This allows this version to complete its line 20 and pass the result 2 to the next version and so on to the first use of FNF which finally returns the value FNF(N) to the PRINT statement that it was used in. The way that FNF works out any factorial is not difficult to understand but it may be difficult to follow so Fig. 1 is included as a summary of the FNF(4) calculation

This description of the FNF function is all very well for anyone with BBC BASIC but what about the rest of us. Well the answer is that there is a simple method of implementing recursive subroutines in almost any version of BASIC. The method relies on the version of BASIC having a good pair of GOSUB and RETURN statements. In particular it is important that you can GOSUB to a subroutine from within a subroutine and still have the RETURN statement take you back to the correct place. In other words it is important that subroutine calls can be 'nested' to a reasonable depth. The main problem in using BASIC subroutines recursively is that each time the subroutine is used a whole new set of variables should come into existence and when the subroutine finishes it should be possible to return to a previous version of the subroutine restoring the old values. The simplest, but incorrect, BASIC recursive implementation of the factorial function is:

```
10 INPUT N
20 GOSUB 1000
30 PRINT F
40 END

1000 IF N=1 THEN F=1:RETURN
1010 N=N-1
1020 GOSUB 1000
1030 F=(N+1)*F
1040 RETURN
```

Subroutine 1000 attempts to use recursion to calculate N! by calling itself at line 1020 to work out an answer for (N− 1)! and then using this in line 1030 to calculate N!. Unfortunately, this doesn't work because the old values of N and F are destroyed each time the subroutine is called. The answer to this is to use an array for each variable in the subroutine and a count of how many times the subroutine has been called. This count is used as an index to the arrays so that effectively a completely new set of variables is produced each time the subroutine is called. For example:

```
10 DIM N(10)
20 DIM F(10)
30 INPUT N(1)
40 I=0
50 GOSUB 1000
60 PRINT F(1)
70 END

1000 I=I+1
1010 IF N(I)=1 THEN F(I)=1:I=I-1:RETURN
1020 N(I+1)=N(I)-1
1030 GOSUB 1000
1040 F(I)=N(I)*F(I+1)
1050 I=I-1
1060 RETURN
```

The two simple variables N and F are now replaced by arrays N(10) and F(10). The variable I counts the number of times that the subroutine is called. Within the subroutine the current values of the variables are in N(I) and F(I) respectively but the result from the previous version of the subroutine is always in F(I+ 1) and the value of N is passed in N(I+ 1). This is how the versions of the subroutine communicate with each other.

This use of arrays to create new versions of the variables each time the subroutine is used is interesting because it imitates the way that languages such as Pascal implement recursion. You may recognise the way the arrays are used with the index I as nothing more than a simple stack.

RECURSIVE SOLUTIONS

The recursive calculation of the factorial function is a good example because it is easy to see how the definition leads to the program. Recursive programs do often arise directly from the implementation of a recursive definition but it is also the case that many problems that seem to have nothing to do with recursion at first sight can be solved by recursion. For example the well-known 'Towers of Hanoi' problem contains no obvious hint of recursion but it is most easily solved by recursion. The Towers of Hanoi problem consists of three pegs numbered 0, 1, and 2 and at the start of the problem there is a pyramid of N discs, smallest at the top on peg 0. The object of the puzzle is to transfer all the discs one at a time to another peg but with the restriction that a larger disc must never be placed on top of a smaller disc. If you have never come across the problem before,

you may not appreciate just how tricky it is. Try it for yourself using four or five coins and you'll soon understand the difficulties. A recursive solution consists of four stages:

1) If N = 1 then move the disc from peg 0 to peg 1 and stop

2) If N >1 then move the top N− 1 discs to peg 2

3) Then move the remaining bottom disc to peg 1

4) Move the N− 1 discs now on peg 2 to peg 1

Steps 2 and 4 are clearly recursive in that they both involve the original problem but with N− 1 discs instead of N. Uncovering this sort of solution is something that gets easier with practice but the main idea is to reduce the problem you are faced with to a solution of a slightly simpler one and then repeat this reduction until the problem is solved.

SUMMING UP

Recursion is a subject that has received much academic attention. Rather than just being an alternative to iteration it may be that recursion is in some way more powerful. In other words there may exist problems that cannot be solved using iteration but can using recursion. More to the point, it is possible that there are practical problems that are significantly easier to solve using recursion. For example, most compilers analyse computer languages using recursive methods. Many of the problems in artificial intelligence seem to be easier to understand and solve using recursive methods. Whatever the truth, recursion is finding its way into computer languages intended for advanced future applications.

On the subject of programming languages the choice of BASIC as the language for examples in this series may seem a little strange — if you want to illustrate advanced or good programming methods and ideas then surely an advanced language would be the best choice. Apart from the obvious advantage of using the most popular and common programming language (ie BASIC) it also serves to emphasise the fact that the techniques are ideas independent of any particular language. BASIC is by no means the last word in programming languages but then neither is the much praised Pascal. It is true that any language that provides extra facilities for writing well structured programs with advanced data types and structures is to be admired but it is always up to the programmer to take advantage of these facilities. I have seen as many badly written programs in Pascal as in BASIC! Programming languages will develop and offer more advanced features as time goes on but it will take a lot to move BASIC from its current position as the number one language. What is likely to happen is that BASIC will develop to include extra features until it becomes nothing like the BASIC that we use today. This has already happened in the sense that BBC BASIC is a much fuller and richer language than the original Dartmouth BASIC.

This aspect of evolution rather than revolution in programming languages is very like the way natural languages develop and why should it be otherwise? As long as the more advanced versions of BASIC include the original as a subset there should be no problems. Until the day that computers program themselves we must continue to find ways of improving the clarity and accuracy of the programs that we write and this will entail the further development and refinement of high level computer languages, BASIC included.

Personal SOFTWARE

Personal Software is a quarterly publication dedicated to all aspects of software for the most popular micros.

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CT April '83

Wendy J Palmer

CLUB CALL

Find fellow micro users in your area

Welcome once again to our regular spot on computer clubs and user groups. Some areas of the country (and of the world) are better represented than others, so if you do not see a club in an area that you know is catered for why not drop us a line?

ORPINGTON COMPUTER CLUB
23 Arundel Drive,
Orpington,
Kent BR6 9JF.
Contact: R A Pyatt (Secretary)
Tel: 66-20281

This well-organised group meets every Friday at 8.00pm at the Church Hall of Christ Church in Charterhouse Road, Orpington. Refreshments are served free at 9.00pm and you can enjoy them without worrying about your micro's safety — members' equipment is insured by the club while it is on the premises, or being carried to and from the club. The club caters for all computer users, beginners or advanced, the aim (and apparently the result) is that the members learn as much as possible from each other. So why not drop in?

JUPITER ACE USERS CLUB
C/o REMSOFT
18 George Street,
Brighton BN2 1RH.
Contact: John Noyce or Doug Bollen
Tel: 0273-602354

The club has been formed to provide a forum for members to exchange information on the Ace; also to produce and market reasonably priced software in cassette based format. In addition the interfacing capabilities of the Ace needs exploring with the possibility of kits being made available cheaply to members. The club is independent of Jupiter Cantab, the creators of the Ace, but it is hoped that a friendly and informative relationship will exist between the two. The annual subscription is £7.00, members getting three newsletters, advice on add-ons, special offers on software and hardware. Brighton-based REMSOFT, a commercial enterprise, has announced the first software for the Jupiter Ace and full details can be obtained from the above address.

THAMES VALLEY COMPUTER CLUB
The Griffin,
Church Road,
Caversham,
Reading.
Contact: Stephen Cole (Secretary)
Tel: 0256-25857

The group meets at The Griffin in Caversham and covers the Newbury, Reading, Bracknell and Maidenhead areas and has been in existence for the last four years. The club has about 75 members ranging from beginners to professionals, who between them have a lot of hardware and software expertise. The main monthly meeting, on the first Tuesday of the month, consists of a talk or demonstration as well as a members' query session and time for refreshment and private conversation. There is a monthly meeting fee of 50p plus an annual subscription of £1.00. The club also has special interest groups which meet in the second half of the month (Z80 group, 6502 group, beginners group and advanced software group). A newsletter is produced every other month detailing previous and future meetings, news etc. The machines in use include Tandy, NASCOM, PET, UK101, BBC, Sinclair and Sharp. Contact Stephen or Phil Warn (Treasurer) on 0734-594874.

BIRMINGHAM NASCOM USER GROUP
Contact: Martin Sidebotham (Secretary)
Tel: 021-744 3093

This group meets on the last Tuesday of every month (except December) at 8.00pm in the upstairs room at Davenports Social Club, Granville Street, Birmingham (behind the Brewery, off Bath Row, near the Birmingham Accident Hospital).

TANGERINE USERS GROUP
1 Marlborough Drive,
Worle,
Avon BS22 0DQ.
Contact: Bob Green
Tel: 0934-21315

Continuing their policy of expansion, TUG has moved to new headquarters as above. This location provides easy access from the western motorway network (M5) allowing monthly meetings between members more easily than was previously possible. With this move comes an increase in staffing levels and the formation of a new research and development team to continue full Microtan system support.

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Contact: Graham Daubney
Tel: 0753-33344

This quarterly news magazine produced by Atari is for Atari Home Computer Club members throughout the UK. Each issue includes a page dedicated to news and views from the user groups. Whether you already belong to a club or would like to recruit and administer one of the groups in your area, Graham would like to hear from you. He can put you in touch with people of a like mind living nearby, lend advice on the most effective ways of setting up and running a computer user group, and of course can relay information on the group's latest finds and activities to other Home Computer Club members. So if you are an Atari user, why not write to Graham and let him help you find others.

If you would like us to have your club included on this page just drop us a line with full details of the club's activities, fees, meeting place, etc, at:

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Please do not forget that if you have sent us details of your club in the past it would help us and our readers if you keep us informed of changes to the information.

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CT April '83

PRINTOUT

Dear Sir,

I was surprised by the 'Multiplication Tutor' listing in your December issue. Not only was there an error in line 100 (which should read: PRINT AT X,Y;etc) but also three pairs of superfluous brackets: in line 60; the outer pair in line 80: and the first pair in line 120 — in a program that goes to extreme measures to reduce size!

Secondly, are you considering reviewing the Jupiter Ace? This seemed an obvious step after your series on FORTH, but no review has yet appeared.

Finally, Graham Blakemore of Loughborough seemed unsure of how to obtain a hard copy of a machine code program on the PET. I suggest that he uses the following:

```
OPEN 5,4
CMD5
```

Enter the monitor and ask for a memory display.

Yours faithfully,
Jonathan Jones
Worcestershire.

(*Yes, the Jupiter Ace is currently undergoing a thorough testing in the hands of our reviewers. The report should be ready for our next issue. Ed.*)

Dear Sir,

Way back in your August issue you published a 'Battleships' type game for the Casio 702P, entitled 'Casio Convoy' (p.30). It contained a small error, with disastrous effects, which I've at last managed to locate. In case other 702P devotees are still struggling I thought you might be interested in my finding . . .

The error is in line 360, where 'IF D≤ 0' should read 'IF D >0'. The effect of the error is to cause the printout 'All Warships Sunk' at every sinking.

Some further points pertaining to this program may be helpful. Firstly it may not be clear to some users that 'DEFM 2' must be entered before the program can be run. Altering 'SHIPS SPEED' to 'SPEED NOW' in line 240 enables the printout from this line to fit the display, eliminating an annoying delay due to scrolling. Finally, ':K=1' added to the end of line 230 prevents 'damage by enemy fire', useful for testing or gaining experience. Actually the whole line could be replaced by this statement, but tacking it on in this way makes it simple to delete later, when the game is to be played properly.

Yours faithfully,
A Flind
Taunton

Dear Sir,

Last month's (February) NASCOM Find program was a real gem, but as a NASCOM 1 with NAS-SYS 3 and BASIC owner, a few mods were required before I could use it.

Firstly, the table values have to be changed, NAS-SYS 3's table is longer and starts earlier in the monitor, so we need:

```
0D 2E   21 82 07   LD HL, 0782H
0D 34   01 7E 00   LD BC, 07EH
```

Secondly, because of the longer table, four of the routines have to be moved therefore all references to these routines have to be changed.

```
FINSTR    0CFE
POSITN    0EFF
NEXLIN    0F01
CLINO     0F03
```

Finally, the call to the old INLIN routine from 0D99 has to be changed as below:

```
0D99 CD F0 02 CALL 02F0H
```

Hopefully, this will help a few readers and, by the way, keep up the good work.

Yours faithfully,
Michael Briggs
Dronfield

Dear Sir,

Paul Kriwaczek, in Viewpoint (January 83), speaks scathingly of 'the rote learning of the Victorian schoolroom, with its emphasis on convergence and conformity' and he goes on to speak in the same paragraph, of 'the alienation . . . and purposelessness felt by so many children' under the present system. Is it not, therefore, possible — just faintly possible — that the apparent inhumanity of Victorian education concealed some virtues lost to our seemingly more enlightened age?

Yours faithfully,
Ronald Cohen
London W11

Dear Sir,

Garry Marshall's article in the February issue was very interesting and informative, but I have spotted the deliberate mistake in the Pascal record declaration! I doubt very much whether any decent compiler would let you call a variable by the name 'type', as this is a reserved word in Pascal. I must admit I was rather baffled by the statement that the features which would allow a program to read records from discs are "usually not implemented in the versions of Pascal that are available for microcomputers". The excellent Hisoft compiler that I run on my Nascom/Gemini system only costs £40, and is not lacking these features. I assume that the other, much more expensive compilers around are equally capable.

Yours faithfully,
Chris Blackmore,
alias Doctor Dark
Taunton

Dear Sir,

May I point out to Colin Hogben (Printout Feb. '83) that if numbers do indeed 'really' exist anywhere in the universe it is in the mental organs of people, wherein they are still but particular arrangements of electric charges.

(Show me an integer and I'll show you an electron.)

Yours faithfully,
Colin Russ
Newbury

PS How about a new column:- 'Philosophy of Computing' Ah well, perhaps not.

Dear Sir,

I own a VIC-20 with both 3K and 8K expansion modules and, as I am also very interested in Astronomy I was pleased to see ▶

your excellent program, Kepler's Revenge, in the January issue. Sadly, it is written for the BBC Micro.

Is there any possibility that you might publish a VIC-20 version of this program or at least print the changes necessary in order to get it to run on the VIC-20?

Your faithfully,
John Curtin
Limerick

(*Whilst I have my doubts that it could be done on the VIC-20 without the extra graphics module I have no doubt that there must be someone who has converted it. If so perhaps you would like to contact Mr Curtin and help him out. Ed.*)

Dear Sir,

Since I am laying out the price of a stamp on sending you the enclosed Reader Survey form, I am making use of the occasion to make comment on two items in the current (January) issue. # File: Leaving aside the position of the PI's knees in the photograph (the position of the throttles does not suggest a stationary aircraft) I wonder if the significance of your statement about not photographing the scenery through the cabin windows has escaped you. In spite of this, you were content to **look** *at the view through them. That picture was adequate. Yet it was taken with a dreadful optical instrument having a rotten little single meniscus lens, projecting the image onto a curved surface of ill-defined geometry. Not only that, but the sensitive surface is on the 'wrong side of the film' and has the shadow of blood vessels cast on it as well as everything else. There must have been some pretty nifty image processing going on between your ears for you to be satisfied with the result: do you not think, perhaps, that this may have been the most intense computing experience of your trip?*

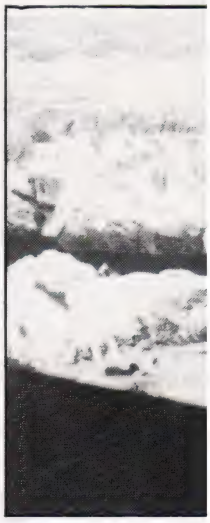
Elegant Programming: This has been a **good** *series, with a very satisfying mixture of items to disagree with as well as new insights to make even an old thickie like myself think again. In the case of the current article, I am slightly worried about Mr James' use of the term 'index' for his array qualifiers. For centuries mathematicians have used the word subscript without noticeable damage to their health. It is used in this sense by most high level languages. Why must he be different? And how will he advise one of his readers who comes to a record in an indexed file comprising a set of qualified names? Let's stick to the convention that names have subscripts and records have indices. Why make life more complicated than it needs to be?*

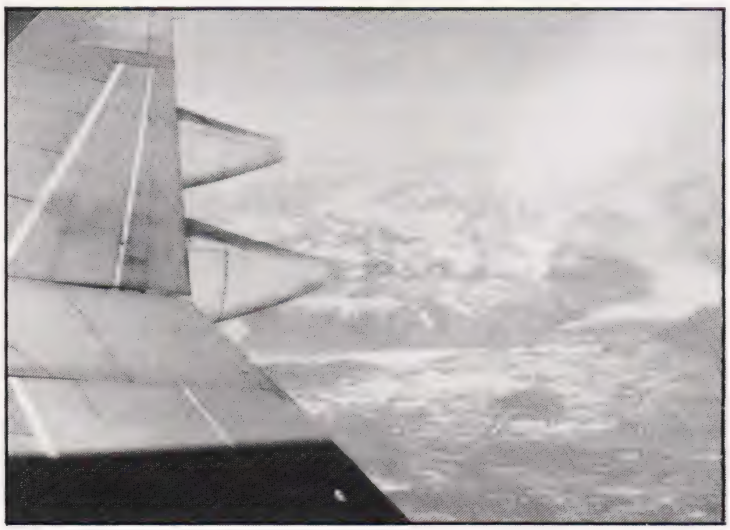
Best wishes to Computing Today for the coming year: it remains one of the best journals that I take.

Yours faithfully,
P H Tanner
Glasgow

(*If we had a 'letter of the month' this would, without a doubt, be it. I had to read the first part twice before the penny dropped but we all have bad days . . . I must confess to a slight case of nerves about the photos we included in the feature and, as someone has raised a query I think that it is time to own up. Long term readers might have recognised the picture of the cockpit as being familiar, we used it to illustrate a report I wrote back in July 1979 on a Computer Show in Orlando, Florida. It is absolutely genuine and the reason that the pilot's knees are not where you might expect is that the plane is on auto-pilot and he's talking to me! The reason that we used the older picture is because the ones I took this time out weren't up to the quality I needed to illustrate the feature. However, the biggest goof of all, no doubt spotted by many, was that having moaned about the quality of pictures taken through a cabin window and raved about the nice views from the cockpit I only went and left out the one taken out of the cockpit! Personally I blame it all on the jet lag . . . The real pictures are given here just to set the matter straight and you can have fun trying to spot the differences in the two cockpits.

Your second point is very fair and I can only say that I agree. However, as we were trying to avoid any complications with mathematics — arrays don't have to be to do with numbers — I used





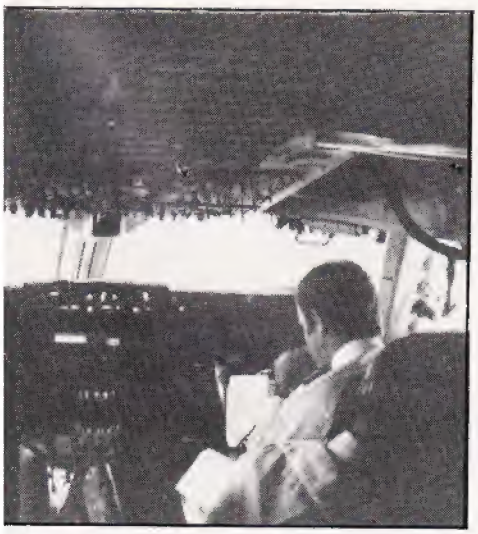
the piece as written and didn't change to the more conventional notations. You might be interested to learn that the series will form the basis of a book by Mr James called **The Complete Programmer** which Granada are due to publish shortly. Ed.*)

Dear Sir,

I am a regular reader of **Computing Today.** *I find it very interesting and enlightening but do you think some programs could be published for the Dragon 32. I am sure many other readers would appreciate this. I found the article 'Enter the Dragon' by Henry Budgett very interesting. Please!! can we have some more like it.*

Yours faithfully,
Colin Wilson
Sunbury-on-Thames

(*There seems to be very little Dragon 32 material filtering back to us at the moment, come on chaps — it's just not good enough! Ed.*)



Dear Sir,

Firstly as a relative newcomer to the world of computing can I say how much I enjoy reading your magazine.

My main reason for writing to you concerns an article in the January edition of **Computing Today** *(page 70) entitled VIC Blow-Up. This would be an excellent program if only it would run! It has been entered correctly into my VIC-20 but when an attempt is made to run it all I get is a mass of characters across the screen as though the program listing is rotating. My young son has programmed it and he gets the same result. Can you help. Do you know of a fault in it?*

Yours faithfully,
G T Richings
Guildford

(*Ah . . . I suspect that you are another victim of the crazy design philosophy of Commodore and have an expanded machine. It does state in the article that the program is for an unexpanded machine, adding more memory can cause problems as various locations get changed — in the case of the 16K add-on your screen moves house to a completely new area in the memory map which tends to make rather a nonsense of the program! As far as we know there are no errors in the published listing which would cause the problem you describe. There is, however, a cosmetic bug in line 270 which produces the incomplete box as seen in the photographs. This can be cured by inserting an SPC immediately after the quote marks that follow the TAB(9) in that line. Ed.*)

Dear Sir,

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Your faithfully,
J P L Hooper
Colchester

Dear Sir,

It is not often that I am inclined to put pen to paper and even less frequently do I actually write to organisations such as yourselves. However, having recently obtained my first copy of **Computing Today**, *I felt I had to write, firstly to congratulate you on a good publication, but secondly to express the opinion that Mike James may be an eloquent programmer but he is certainly not an eloquent writer.*

As a novice, struggling to comprehend obtuse statements in computer manuals it was refreshing to read something as down to earth as Henry Budgett's PEEK and POKE Explained. Why, even I understood it! But then I came to Mike James. Mr James, why use a paragraph when you could use a sentence? You wrapped up some basic concepts, such as arrays, in so many words I thought for a while that I was about to be initiated into something new and complex, but no, it was just multidimensional arrays so badly explained it was worthy of a CBM manual.

Please, Editor, try to keep it chatty and down to earth for we poor mortals.

Yours faithfully,
Brian C Holley
Stroud

(*Who *is* this Henry Budgett, that's twice he's been mentioned this month. Damn chap'll be wanting *my* job next! Glad you enjoyed the first piece though — what about the second part?

We try to cover a wide area of competence in every issue, reader research has shown that our 'average' reader is usually fairly used to his or her machine so we tend to run more advanced material than beginner's features. Don't get me wrong, we certainly won't ignore you and that's exactly why we run articles like PEEK and POKE. To try to give the new reader an insight into the article in front of him we 'flag' the level and type of material contained in each piece at the top of the page, Mr James' article is clearly marked as being an advanced feature and not one for the beginner.

By the way, likening Mike's much appreciated material to a Commodore manual is a bit strong don't you think? Rather, perhaps, a BBC User Guide. Ed.*)

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M Williams

LOWER CASE UK101

Reduce eyestrain on your UK101 by changing the character display to lower case.

This program is intended for use with a Compukit UK101 and is an aid for those of you with eyes strained from looking at the UK101's screen.

The UK101's screen format of 16 lines by 48 characters results in very rectangular letters which quickly fill up the screen and appear very close together. This program converts all upper case letters printed on the screen to lower case, thus vastly improving readability. The program is only 14 bytes long and resides in the 'spare' memory below BASIC, so once entered will only be cleared by switch-off. Once the BASIC program has been run, it can be cleared from memory with NEW, as it only serves to enter the machine code into memory.

If a Warm or Cold start is initiated, the program can be reactivated by POKE 538,64: POKE 539,2. To deactivate the program, enter POKE 538,75.

```
10  FOR I=576 TO 589:READ A:
    POKE I,A:NEXT I
20  POKE 538,64:POKE 539,2
30  DATA 201,65,144,7,201,91,176
40  DATA 3,24,105,32,76,212,251
```

Note that if your UK101 has the old monitor, change line 40 to:

```
40  DATA 3,24,105,32,76,105,255
```

The machine code is very simple and is included as Listing 1.

```
0240 C9 41      CMP #$41      Test if upper
0242 90 07      BCC $024B     upper case
0244 C9 5B      CMP #$5B      character
0246 B0 03      BCS $024B
0248 18         CLC           If so add 20 Hex
0249 69 20      ADC #$20      to make it lower
024B 4C D4 FB   JMP $FBD4     BASIC PRINT
```

Listing 1.

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CT STANDARDS

Our regular page explaining the meaning of the various symbols we use to make programs portable.

It has been very encouraging to see the number of programs submitted using our standard codes for graphics and other non-printable characters. However, it has also become increasingly clear that some of our readers haven't heard of them and this page is intended to set them out once again.

All standards tend to be irksome to adhere to but the ones laid out here are fairly simple and tend to make software easier to maintain by the programmer and simpler to understand for others.

CONTROL THAT CURSOR

Our original standards have now grown with the times. Machines such as the Commodore VIC which have a dual Shift capability can now be incorporated, as can those systems which use Control key functions.

The recently introduced BBC system offers pre-programmed function keys which we are glad to say, can also be handled by our original coding system. It's nice to see just how well adapted the original standards have become over the last two years! (Indeed, a whole series of books is using them as its ***de-facto*** standard.) The standards for the cursor controls are given in Fig. 1.

[CLS]	CLear Screen
[HOM]	HOMe cursor
[CL]	Cursor Left
[CR]	Cursor Right
[CU]	Cursor Up
[CD]	Cursor Down
[REV]	REVerse video on
[OFF]	Turn it OFF
[SPC]	SPaCe
[CTL]	ConTroL key
[fn]	Function key (BBC)
[G<]	Graphic left (VIC/MZ-80A)
[G>]	Graphic right (VIC/MZ-80A)

Fig. 1. Our extended set of cursor control standards includes four new functions.

To indicate more than one of the above, an optional number can be placed within the brackets; [4 CL], etc.

The use of square brackets has raised one or two queries. The reason for this choice is that ***most*** of the common microcomputer BASICs don't use them for specific functions. In fact, at least one machine provides an added bonus by returning a Syntax Error if they are found, a useful check in case you type them in by mistake.

The code [SPC] was added to the list of cursor control codes to get over the problem of indicating just how many spaces are contained in the gap in the printout. The other common variant of the code for spaces is used by the ZX people. Their choice was ~ and this crops up in the various newsletters they publish.

The code [RVS] has caused a few headaches. This is really specific to the PET where the character set can be displayed in reversed video. On machines which don't have this facility you should either find a character in the set which is the reversed image of the one you want and use that or simply ignore it and use anything else you fancy! Don't forget, you may have to look up and alter the values used elsewhere in the program.

THE GRAPHIC SOLUTION

It soon became obvious that the techniques applied to the confusing cursor controls could also be applied to the graphics symbols. The following standard is now in general use in programs published in *Computing Today*.

If a graphics character or characters are to be displayed in a listing (as opposed to POKE codes or CHR$( ) codes) then they are indicated by the method shown in Fig. 2.

Several people have asked what the relationship between the POKE value for a character and that of its shifted graphic might be. In general the shifted version of any character will be 64 greater than the value of that character. This applies to both PET and MZ-80K systems in all cases.

This can be taken further to include machines which use a pixel graphics set rather than pre-programmed PET-style characters and the series of codes for these is given in Fig. 3. As is nearly always the case there is one machine to which the standard shown in Fig. 3 does not apply — Tangerine's Microtan/Micron. This machine uses a four by two cell structure for its pixel graphics instead of the Prestel/Teletext three by two cell. The method for calculating the value to assign to 'P' is shown in Fig. 4, and is fortunately nice and simple.

MAKING REMARKS

Many people scorn the use of REMs within programs but, during the development at least, they are extremely useful. One of the documentation methods that we use is to keep our back-up copy of our programs on a 300 Baud CUTS tape with all the REMs in place, the working copy, be it on tape or disc, is REMless in order to save space.

It is also good programming 'manners' to give your REMs odd line numbers:

```
3999 REM ** CRASH PROOF INPUT **
4000 INPUT "THE NUMBER OF ENTRIES";A
```

A remarkable number of submitted programs have jumps that go not to the relevant point in the program, but to the REM statement. This can cause severe problems when re-numbering after removing the REMs.

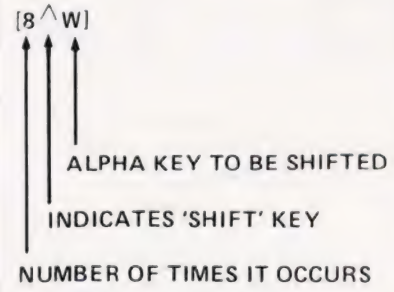

Fig. 2. The way we indicate block graphics on machines like the PET and Sharp. The VIC system of Shift Left and Shift Right is shown in Fig. 1.

1	2
4	8
16	32
64	128

Fig. 4. To convert a Tangerine pixel code into its blocks, simply decode the number into its binary or Hex value and fill in the relevant squares.

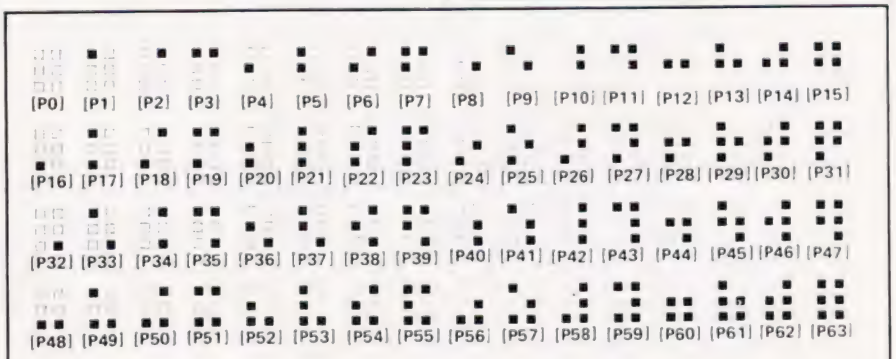

Fig. 3. The standard pixel codes; they will work on most computers which employ this technique as well as for Teletext and Prestel.

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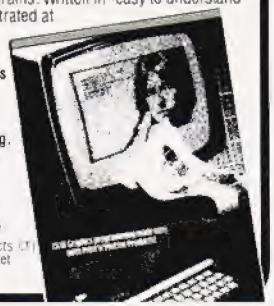

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